This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

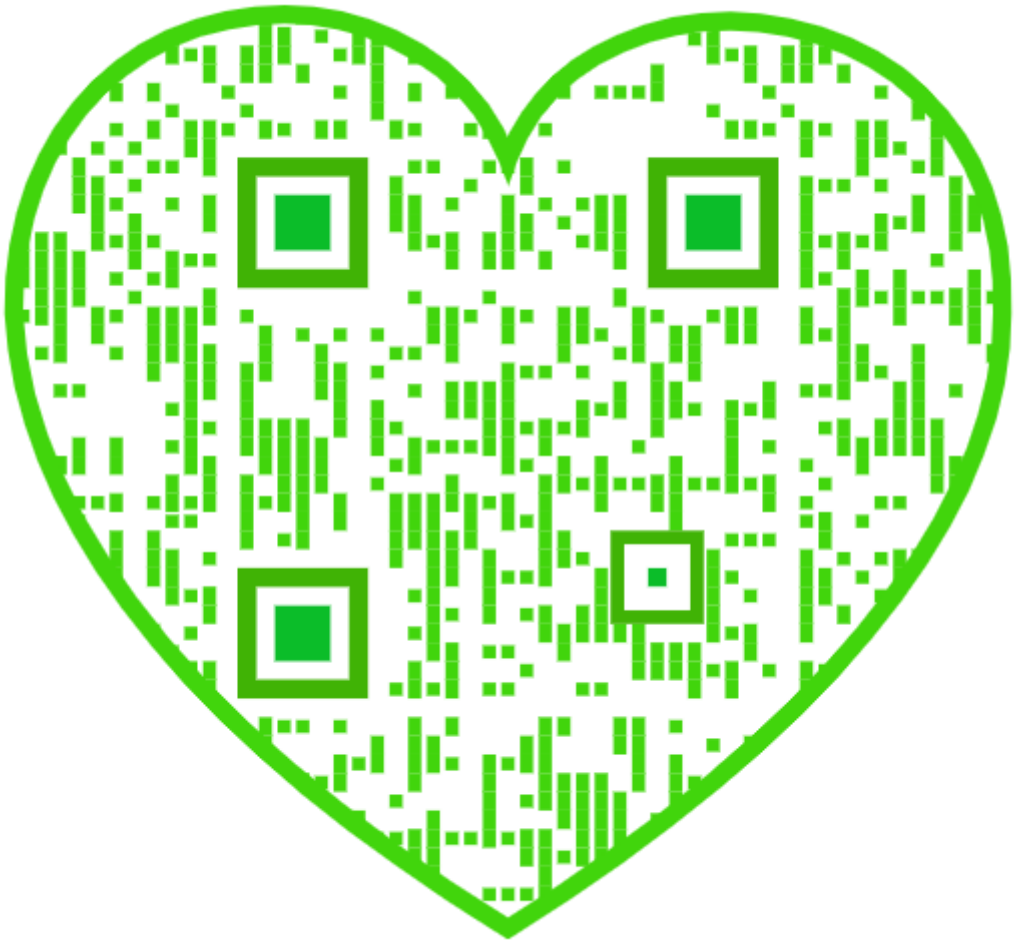
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



Arithmetic by Grades for Inductive Teaching, Drilling and ...

John Tilden Prince

Digitized by Google

T 118.94.700. BR6

HARVARD UNIVERSITY

LIBRARY OF THE

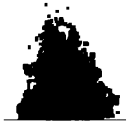
Department of Education

COLLECTION OF TEXT-BOOKS
Contributed by the Publishers

TRANSFERRED
TO
COLLEC
RY

Digitized by Google

3 2044 097 003 396



Digitized by Google

Digitized by Google

ARITHMETIC BY GRADES

FOR INDUCTIVE TEACHING, DRILLING AND TESTING

BOOK NUMBER SIX

Mensuration, Denominate Numbers, Metric System, Percentage and Simple Applications, Business Transactions and Accounts

PREPARED UNDER THE DIRECTION OF
JOHN T. PRINCE

BOSTON, U.S.A.
GINN & COMPANY, PUBLISHERS
1894

Digitized by Google

I 5.736
Educ T 113.74.700 Bk 6
HARVARD COLLEGE LIBRARY
TRANSFERRED FROM THE
LIBRARY OF THE
GRADUATE SCHOOL OF EDUCATION

Harvard University,
Dept. of Education Library

COPYRIGHT, 1894,
BY JOHN T. PRINCE.

ALL RIGHTS RESERVED.

The Athenæum Press
GINN & COMPANY, BOSTON, U.S.A.

Digitized by Google

NOTE TO TEACHERS.

THE attention of teachers is called to the following features of this series of books — features which should be kept in mind as the various subjects are presented.

1. The separation of teachers' and pupils' books, whereby pupils may be taught properly and may not be given too great assistance. Suggestions as to methods of teaching and drilling, as well as the illustrative processes, explanations, rules, and definitions which belong to the teacher to develop analytically are put into the Teachers' Manual, while in the pupils' books are presented only such exercises as are needed for practice.

2. The careful gradation of problems, by which pupils acquire inductively a knowledge of arithmetical relations and principles, and skill in arithmetical processes. This is in recognition of the well-known pedagogical principles of proceeding from the known to the unknown, and from the simple to the complex. It is advised that this plan be kept constantly in mind by the teacher, and that whenever a process is not understood or is not readily performed, the pupils should be taken back to processes which are well known and which can be performed readily, and then should be led forward by easy steps until the desired end is reached.

3. Frequent reviews, and such an arrangement of exercises as will enable pupils to have needed practice in the applications of each principle, first by itself, and afterwards in connection with other principles which have been learned.

4. The large amount of oral work, or work which may be done without the aid of figures. Three objects of Mental Arithmetic are sought in these exercises : (*a*) Illustration of principles and a preparation for written work, (*b*) Development of the logical powers, (*c*) Cultivation of ability to work with large numbers by short processes.

Digitized by Google

5. The great number and variety of problems. The aim has been to give the *largest number* of problems that will be needed for teaching and for drilling in all grades. For this reason, and because the forms of expression are varied, being taken from many sources, there will be no necessity of giving supplementary drill lessons on the blackboard. Blackboard lessons are objectionable not only on account of a waste of the teachers' time and strength, but also on account of the injury done to pupils' eyes in much reading and copying from the blackboard.

6. Practicalness of work in respect to the character of the problems, and the solution of them. Care has been taken to give problems which are most likely to be met in every-day life, and to give them in a practical form. Many of the miscellaneous review problems were made by mechanics, clerks, accountants, etc., with a view of presenting conditions most likely to occur.

7. The introduction of statistics and facts of physics, astronomy, history, geography, etc., thus enabling pupils to gain incidentally much useful information.

8. The use of drill tables and other devices to save the time of teachers.

In addition to the above features, some of which are distinctively new so far as American text-books are concerned, there is the separation of pupils' exercises for practice into small books somewhat on the lines of gradation in City graded schools. By this arrangement there are gained greater convenience of handling and economy of wear than in the use of a large book which is intended to be used for several years by the same pupil.

The problems of Section I of this book are given as a review of previous work. Little time need be given in drill upon them, if the work of previous books has been thoroughly done.

The continued use of objects in teaching Mensuration and Denominate Numbers is strongly advised as well as the pupils' practice of drawing in the illustration of problems, especially when such drawing will tend to make clear an unfamiliar or difficult process. Since the Metric System of Measures and Weights is not in common use, it is not necessary to give very extended or long continued practice in it. Yet enough of practice should be given to show the pupils the great advantage of simplicity and economy of time that it has over our complex system.

Digitized by Google

A clear statement of steps in brief formulas should be insisted upon until the principle or process is thoroughly known. Such statement should include what is asked for in the problem and the conditions that are given. The solution of problems by short processes and "on a line" by cancellation should be encouraged when the problems are not difficult.

It will be observed that an exhaustive study of the applications of percentage is not called for at this stage but only a study of the more general and simple applications which are likely to occur in business. A fuller and more systematic presentation of Interest, Profit and Loss, Banking, Insurance, etc. is made in the next book.

The problems given in the last three pages of the book indicate a kind of work which may be done profitably in connection with other subjects of instruction.

For methods of teaching the various subjects and for answers to problems see Teachers' Manual which is designed to accompany all books of the series.

Digitized by Google

Digitized by Google

CONTENTS.

SECTION		PAGES
I.	Oral and Written Review Exercises	1–8
II.	Mensuration	9–24
III.	Denominate Numbers	25–38
IV.	Metric System of Measures and Weights	39–46
V.	Percentage and Applications	47–70
VI.	Business Transactions	71–76
VII.	Miscellaneous Exercises	77–90
	Tables	91–92

Digitized by Google

Digitized by Google

SECTION I.

REVIEW EXERCISES.

Oral and Written.

Add by columns and by lines :

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
11.	42	38	76	49	53	84	97	65	83	46
12.	79	96	43	93	75	79	76	90	39	99
13.	97	45	88	36	39	46	58	29	93	76
14.	55	59	52	82	84	83	93	75	48	33
15.	61	86	36	27	68	93	29	88	84	52
16.	87	32	61	71	82	16	45	67	64	87
17.	28	67	98	44	96	38	18	27	52	28
18.	66	71	25	68	51	97	67	71	47	36
19.	84	28	57	75	27	42	59	16	21	65
20.	48	64	74	59	75	29	83	38	95	79
21.	39	29	59	85	48	83	77	65	75	48
22.	93	86	94	46	83	47	81	83	56	45
23.	35	52	67	53	14	63	94	44	96	17
24.	58	45	18	39	69	87	72	59	77	87
25.	16	33	46	94	93	34	45	33	87	54
26.	76	18	87	27	77	28	36	56	38	28
27.	92	74	35	61	52	44	62	42	63	66
28.	47	97	76	18	76	58	54	94	69	83
29.	86	38	89	75	68	89	48	43	94	34
30.	75	44	97	56	87	97	83	37	48	49
31.	53	75	73	63	74	74	36	78	82	92
32.	39	57	35	39	49	45	69	84	27	27
33.	96	62	58	94	95	59	95	49	74	75
34.	38	96	84	48	53	33	57	38	45	56

Digitized by Google

Add vertically and horizontally:

	1.	2.	3.	4.	5.	6.	7.	18.
8.	$6.94 +	$8.72 +	$3.83 +	$9.71 +	$4.28 +	$8.35 +	$4.37 =	$——
9.	8.57 +	7.88 +	8.98 +	6.43 +	8.39 +	7.64 +	3.45 =	——
10.	3.78 +	9.59 +	4.72 +	8.34 +	5.42 +	8.17 +	9.48 =	——
11.	4.20 +	5.94 +	9.26 +	4.11 +	8.37 +	7.63 +	7.28 =	——
12.	9.85 +	2.67 +	5.43 +	7.75 +	5.49 +	2.74 +	1.08 −	——
13.	7.49 +	6.36 +	8.65 +	2.52 +	6.48 +	1.96 +	7.69 =	——
14.	5.16 +	3.75 +	6.17 +	6.93 +	7.83 +	8.37 +	9.42 =	——
15.	2.63 +	4.42 +	7.59 +	3.79 +	2.19 +	6.45 +	7.37 =	——
16.	1.35 +	1.23 +	7.30 +	5.86 +	7.42 +	5.27 +	4.55 =	——
17.	$— +	$— +	$— +	$— +	$— +	$— +	$— =	$——

Add vertically and horizontally:

	19.	20.	21.	22.	23.	32.
24.	$864.28 +	$87.94 +	$160.48 +	$28.93 +	$74.83 =	$——
25.	15.96 +	428.33 +	948.55 +	418.74 +	583.74 =	——
26.	78.80 +	72.38 +	59.99 +	37.55 +	9.69 =	——
27.	394.63 +	684.19 +	60.43 +	613.84 +	348.74 =	——
28.	70.92 +	83.96 +	378.76 +	564.23 +	79.68 =	——
29.	498.75 +	748.67 +	46.87 +	38.76 +	43.09 =	——
30.	583.48 +	83.38 +	697.30 +	8.42 +	765.83 =	——
31.	$——	$——	$——	$——	$——	$——

In each of the above columns find the difference between:

33. 24 and 25.	36. 27 and 28.	39. 24 and 31.	42. 27 and 31.
34. 25 and 26.	37. 28 and 29.	40. 25 and 31.	43. 28 and 31.
35. 26 and 27.	38. 29 and 30.	41. 26 and 31.	44. 29 and 31.

In each of the above lines find the difference between:

45. 19 and 20.	49. 19 and 21.	53. 19 and 32.
46. 20 and 21.	50. 20 and 22.	54. 20 and 32.
47. 21 and 22.	51. 21 and 23.	55. 21 and 32.
48. 22 and 23.	52. 19 and 22.	56. 22 and 32.

Digitized by Google

1. The public debt *per capita* of Canada in 1891 was $61.28. If her population was 4,829,411, what was her total debt?

2. The total debt of the United States in 1890 was $1,281,020,840. What was her debt *per capita*, the population being 62,622,250?

3. Find all the facts you can from the following table showing the United States' imports from and exports to various countries:

Countries.	1891.		1892.	
	Imports from.	Exports to.	Imports from.	Exports to
England	$169,069,346	$397,412,936	$130,967,694	$423,848,515
France	76,688,995	60,693,190	68,554,793	99,126,707
Germany	97,316,383	92,795,456	82,997,553	105,521,558
Brazil	83,230,595	14,120,346	118,633,604	14,291,873
Mexico	13,512	55,161	21,271	35,513
Cuba	61,714,395	12,224,888	77,931,671	17,953,570

4. 448×10? 84.4×100? 78.46×1000?

5. $860 \div 10$? $9740 \div 100$? $327.6 \div 1000$?

6. 48.86×100? $378.4 \div 100$? 8.09×1000?

7. $.086 \times 10{,}000$? $9000 \div 1000$? $7.08 \div 1000$?

8. $18.69 \times 100 \div 10 \times 1000 \div 100 \times 10 \div 1000 \times 10{,}000$?

9. Multiply: 23,864 by 30; 80; 600; 400; 3000; 9000.

10. Multiply: 30,806 by 40; 49; 800; 850; 856; 345.

11. Multiply: 60,094 by 27; 843; 976; 8600; 7940.

12. Multiply: 97,540 by 385; 743; 609; 7080; 9008.

13. Multiply: 4865 by 480; 7850; 8650; 7089; 8005.

14. Multiply: 70,865 by 8040; 7609; 7009; 83,006; 10,080.

15. Divide: 1,803,946 by 16; 25; 200; 380; 186; 384.

16. Divide: 7,500,705 by 25; 38; 120; 98; 236; 475.

17. Divide: 10,000,000 by 80; 125; 63; 440; 238; 6840.

18. Divide: 40,080,060 by 70; 300; 480; 126; 503; 8064.

19. Divide: 73,896,402 by 39; 78; 97; 138; 369; 489.

20. Divide 601,004,380 by 58; 73; 99; 127; 430; 4096.

Digitized by Google

1. $\frac{25 \times 160 \times 13 \times 90}{51 \times 30 \times 8 \times 15} = ?$ 2. $\frac{400 \times 124 \times 64 \times 72}{36 \times 75 \times 18 \times 24} = ?$

3. $\frac{27 \times 35 \times 150 \times 112 \times 180 \times 17}{80 \times 14 \times 81 \times 49 \times 85 \times 90} = ?$

4. $\frac{8693 \times 484 \times 783 \times 1600 \times 835}{603 \times 224 \times 3800 \times 75} = ?$

a. $0.84	*g.* $42.60	*m.* $78.96	*s.* $446.28
b. 1.60	*h.* 38.80	*n.* 120.00	*t.* 832.40
c. 6.40	*i.* 40.90	*o.* 236.40	*u.* 639.27
d. 8.60	*j.* 46.08	*p.* 286.20	*v.* 827.46
e. 12.40	*k.* 50.02	*q.* 264.36	*w.* 532.46
f. 26.30	*l.* 76.82	*r.* 220.42	*x.* 624.32

5. Multiply each of the above numbers by 10; 100; 50; 25; 20; 30; 40; 60; 75; 1000; 6000; 8000.

6. Divide each of the above numbers by 10; 100; 50; 25; 20; 30; 40; 75; 1000; 4000; 8000; 5000.

7. Copy and fill out the following bill of sale:

Richmond, Va., Sept. 16, 1893.

Messrs. Smith & Armstrong.

Bought of ASA ELDRIDGE & CO.

384 bu. Oats	@ *52¢*,		
136 lb. Tea	@ *65¢*,		
327 lb. Java Coffee	@ *25¢*,		
38 bbl. Flour	@ *$4.75*,		
304 bu. Corn	@ *67½¢*,		
2760 lb. Sugar	@ *4½¢*,		

8. Make out a bill such as might be made by the clerk or bookkeeper of a dry goods store. Let the bill contain five items, and let it be properly receipted.

Digitized by Google

Add by columns and by lines :

	1.	2.	3.	4.	5.	
6.	$\frac{2}{3}$	$+\frac{3}{4}$	$+\frac{5}{12}$	$+\frac{7}{8}$	$+\frac{5}{6}$	$=?$
7.	$\frac{5}{6}$	$+\frac{2}{3}$	$+\frac{7}{8}$	$+\frac{7}{12}$	$+\frac{1}{4}$	$=?$
8.	$\frac{3}{8}$	$+\frac{1}{6}$	$+\frac{3}{4}$	$+\frac{5}{6}$	$+1\frac{1}{2}$	$=?$
9.	$\frac{1}{2}$	$+\frac{5}{8}$	$+\frac{2}{3}$	$+\frac{1}{4}$	$+\frac{19}{24}$	$=?$
10.	$\frac{3}{4}$	$+\frac{5}{12}$	$+\frac{1}{6}$	$+\frac{1}{2}$	$+\frac{1}{3}$	$=?$
	?	+ ?	+ ?	+ ?	+ ?	$=?$

	11.	12.	13.	14.	15.	
16.	$\frac{7}{8}$	$+\frac{5}{6}$	$+1\frac{1}{2}$	$+\frac{3}{4}$	$+\frac{2}{3}$	$=?$
17.	$\frac{1}{6}$	$+\frac{5}{9}$	$+\frac{5}{8}$	$+1\frac{7}{24}$	$+\frac{3}{4}$	$=?$
18.	$\frac{7}{9}$	$+\frac{1}{2}$	$+1\frac{5}{36}$	$+1\frac{7}{18}$	$+\frac{8}{8}$	$=?$
19.	$1\frac{11}{24}$	$+1\frac{7}{12}$	$+\frac{2}{3}$	$+\frac{5}{9}$	$+1\frac{5}{18}$	$=?$
20.	$\frac{23}{36}$	$+\frac{3}{4}$	$+\frac{7}{9}$	$+1\frac{7}{12}$	$+\frac{23}{24}$	$=?$
	?	+ ?	+ ?	+ ?	+ ?	$=?$

	21.	22.	23.	24.	25.	26.	27.	
28.	$4\frac{4}{9}$	$+2\frac{7}{12}$	$+1\frac{5}{8}$	$+6\frac{15}{16}$	$+3\frac{1}{4}$	$+7\frac{1}{8}$	$+2\frac{5}{6}$	$=?$
29.	$8\frac{5}{72}$	$+7\frac{11}{36}$	$+9\frac{5}{12}$	$+9\frac{1}{24}$	$+7\frac{2}{3}$	$+2\frac{13}{18}$	$+5\frac{7}{9}$	$=?$
30.	$3\frac{7}{18}$	$+9\frac{1}{3}$	$+3\frac{17}{36}$	$+5\frac{1}{6}$	$+3\frac{11}{24}$	$+7\frac{31}{72}$	$+3\frac{17}{48}$	$=?$
31.	$9\frac{11}{12}$	$+4\frac{1}{6}$	$+2\frac{41}{72}$	$+7\frac{11}{18}$	$+9\frac{5}{9}$	$+6\frac{5}{8}$	$+5\frac{5}{24}$	$=?$
	?	+ ?	+ ?	+ ?	+ ?	+ ?	+ ?	$=?$

32.	33.	34.	35.	36.
$1-\frac{3}{8}$	$1\frac{3}{4}-\frac{7}{8}$	$1\frac{1}{9}-\frac{5}{6}$	$3\frac{1}{12}-\frac{8}{9}$	$5\frac{3}{14}-1\frac{5}{6}$
$\frac{3}{4}-\frac{1}{8}$	$2\frac{1}{2}-\frac{5}{6}$	$2\frac{1}{8}-\frac{7}{10}$	$2\frac{11}{18}-1\frac{1}{2}$	$6\frac{7}{21}-1\frac{3}{4}$
$\frac{7}{8}-\frac{3}{4}$	$1\frac{1}{3}-\frac{5}{12}$	$3\frac{1}{9}-\frac{5}{12}$	$3\frac{15}{18}-\frac{6}{10}$	$6\frac{5}{12}-2\frac{17}{20}$
$\frac{8}{9}-\frac{3}{4}$	$2\frac{1}{12}-\frac{2}{3}$	$7\frac{1}{8}-\frac{7}{12}$	$4\frac{5}{16}-\frac{3}{5}$	$8\frac{7}{9}-2\frac{9}{10}$
$\frac{4}{5}-\frac{1}{2}$	$2\frac{2}{3}-\frac{3}{4}$	$8\frac{1}{15}-\frac{9}{10}$	$4\frac{1}{24}-1\frac{3}{18}$	$7\frac{1}{15}-3\frac{4}{25}$

37. $24\frac{1}{3}\frac{7}{4}-13\frac{5}{6}$.
38. $42\frac{1}{3}\frac{8}{2}-12\frac{7}{12}$.
39. $27\frac{3}{16}-7\frac{9}{20}$.
40. $34\frac{7}{30}-3\frac{1}{2}\frac{9}{1}$.
41. $48\frac{2}{27}\frac{3}{7}-18\frac{8}{30}$.
42. $18\frac{1}{80}-15\frac{1}{9}$.
43. $29\frac{3}{35}-11\frac{5}{28}$.
44. $44\frac{6}{32}-14\frac{7}{30}$.
45. $38\frac{7}{40}-12\frac{11}{30}$.
46. $56\frac{7}{24}-5\frac{1}{36}\frac{5}{}$.
47. $41\frac{7}{11}-22\frac{1}{12}\frac{1}{}$.
48. $4\frac{1}{16}-3\frac{1}{8}$.
49. $18\frac{1}{2}-7\frac{7}{8}$.
50. $7\frac{2}{3}-5\frac{5}{8}$.
51. $4\frac{8}{8}-1\frac{9}{10}$.

52. From $146\frac{3}{4}+18\frac{17}{60}+126\frac{13}{45}$ take $146\frac{13}{30}+84\frac{17}{24}$.
53. From $74\frac{5}{16}+27\frac{5}{8}+38\frac{14}{15}$ take $23\frac{11}{20}+48\frac{14}{15}$.

54. $\frac{8}{9}\times 6$.	59. $4\frac{8}{9}\times 6\frac{1}{2}$.	64. $8\frac{4}{5}\times 7\frac{1}{2}$.
55. $\frac{7}{8}\times 16$.	60. $5\frac{2}{3}\times 8\frac{3}{4}$.	65. $5\frac{5}{6}\times 8\frac{3}{7}$.
56. $1\frac{4}{5}\times 20$.	61. $8\frac{3}{10}\times 6\frac{5}{9}$.	66. $12\frac{3}{20}\times 5\frac{19}{14}$.
57. $2\frac{5}{6}\times 7$.	62. $7\frac{5}{8}\times 14\frac{4}{30}$.	67. $9\frac{8}{9}\times 6\frac{3}{40}$.
58. $3\frac{5}{9}\times 12$.	63. $14\frac{4}{5}\times 7\frac{6}{30}$.	68. $7\frac{4}{5}\times 3\frac{3}{4}$.

Digitized by Google

1. Multiply the sum of $12\frac{2}{3}$ and $4\frac{5}{18}$ by $6\frac{6}{9}$.
2. Multiply $18\frac{4}{15} + 3\frac{7}{90} + 6\frac{5}{8}$ by $4\frac{2}{3}$.
3. Divide $\frac{2}{3}$ of $4\frac{1}{4} + \frac{3}{4}$ of 10 by $2\frac{4}{5}$.

4.	5.	6.	7.	8.
$\frac{1}{3}$ of 3	$\frac{1}{3}$ of $\frac{3}{4}$	$2 \div \frac{1}{2}$	$4\frac{1}{2} \div \frac{1}{2}$	$\frac{1}{2} \div \frac{1}{3}$
$\frac{1}{9}$ of 4	$\frac{1}{2}$ of $\frac{4}{5}$	$4 \div \frac{1}{3}$	$2\frac{1}{4} \div \frac{3}{4}$	$2\frac{1}{2} \div \frac{2}{5}$
$\frac{1}{12}$ of 7	$\frac{1}{8}$ of $\frac{8}{9}$	$6 \div \frac{1}{5}$	$3\frac{1}{2} \div \frac{7}{8}$	$12\frac{3}{4} \div 4\frac{1}{2}$
$\frac{1}{15}$ of 2	$\frac{1}{2}$ of $\frac{7}{9}$	$4 \div \frac{2}{3}$	$2\frac{1}{2} \div \frac{1}{8}$	$6\frac{1}{4} \div 5\frac{1}{2}$
$\frac{1}{24}$ of 5	$\frac{1}{15}$ of $\frac{8}{15}$	$6 \div \frac{3}{4}$	$9 \div 1\frac{2}{3}$	$16\frac{2}{3} \div 12\frac{1}{2}$

9.	10.	11.	12.	13.
$1\frac{2}{3} \div \frac{1}{2}$	$7\frac{2}{3} \div 1\frac{1}{2}$	$\frac{1}{12}$ of $8\frac{5}{8}$	$100 \div \frac{1}{8}$	$18\frac{1}{2} \div 1\frac{2}{3}$
$3\frac{5}{8} \div \frac{2}{3}$	$6\frac{1}{4} \div 1\frac{8}{9}$	$\frac{3}{16}$ of $15\frac{1}{3}$	$75 \div 8\frac{1}{3}$	$16\frac{1}{4} \div 8\frac{1}{3}$
$4\frac{1}{4} \div \frac{2}{3}$	$3\frac{1}{2} \div 1\frac{2}{3}$	$\frac{5}{18}$ of $12\frac{2}{3}$	$64 \div 9\frac{1}{7}$	$66\frac{2}{3} \div 37\frac{1}{2}$
$8\frac{1}{3} \div \frac{5}{6}$	$10\frac{1}{2} \div 2\frac{1}{2}$	$\frac{6}{25}$ of $16\frac{2}{3}$	$150 \div 9\frac{3}{8}$	$37\frac{1}{2} \div 16\frac{2}{3}$
$7\frac{1}{2} \div 3\frac{1}{3}$	$43\frac{1}{3} \div 20$	$\frac{1}{14}$ of 50	$48 \div 9\frac{3}{5}$	$50 \div 37\frac{1}{2}$

Reduce to simple fractions :

14. $\frac{12\frac{1}{3}}{8}$; $\frac{7\frac{1}{8}}{4}$; $\frac{14\frac{1}{8}}{6}$; $\frac{15\frac{2}{3}}{9}$; $\frac{14\frac{1}{2}}{10}$; $\frac{23\frac{2}{3}}{18}$; $\frac{16\frac{1}{2}}{9}$; $\frac{14\frac{4}{5}}{10}$.

15. $\frac{1\frac{1}{2}}{\frac{1}{2}}$; $\frac{3\frac{4}{5}}{\frac{1}{10}}$; $\frac{21\frac{2}{3}}{11\frac{2}{3}}$; $\frac{2\frac{1}{8}}{1\frac{5}{16}}$; $\frac{6\frac{2}{3}}{1\frac{1}{3}}$; $\frac{8\frac{1}{2}}{7\frac{2}{3}}$; $\frac{8\frac{5}{6}}{3\frac{1}{12}}$; $\frac{100}{8\frac{1}{3}}$.

16. $\frac{4 \times 6}{8}$; $\frac{13\frac{3}{8} \times 4}{18}$; $\frac{34\frac{1}{2} \times 6 \times 8\frac{1}{3}}{16\frac{2}{3} \times 8\frac{1}{2} \times 3}$; $\frac{9\frac{2}{7} \times 3\frac{1}{3} \times 4}{10 \times 1\frac{1}{3} \times \frac{1}{5}}$.

What part of

17. 4 is 3? $\frac{1}{2}$ is $\frac{1}{4}$? 6 is $\frac{1}{3}$? $4\frac{1}{2}$ is $\frac{1}{2}$?
18. $2\frac{2}{3}$ is $\frac{1}{3}$? $3\frac{1}{2}$ is $\frac{3}{4}$? $\frac{7}{8}$ is $\frac{3}{4}$? $\frac{8}{9}$ is $\frac{3}{4}$?
19. 6 is 4? $\frac{1}{8}$ is $\frac{1}{4}$? $3\frac{1}{2}$ is $2\frac{1}{2}$? $8\frac{1}{3}$ is $6\frac{2}{3}$?
20. $7\frac{1}{8}$ is $3\frac{3}{4}$? $8\frac{6}{15}$ is $3\frac{1}{3}$? $36\frac{2}{3}$ is 20? $4\frac{1}{7}$ is $2\frac{2}{3}$?
21. 4.5 + 6.008 + 3.0109 + .4073 + .009.
22. 7.008 + .0806 + 14.08 + 600.07 + 6.0908.
23. From 8.097 + 18.809 + 16.079 take 15.9087.
24. From 2000 take 148.076 + 8.0084 + 16.0907.

Digitized by Google

1. .2 of 4; .02 of 8; .002 of 40; .0002 of 800.

2. .03 of 20; .006 of 40; .05 of 10; .008 of .4.

3. .8 of .02; .06 of .005; .0012 of 4.08; .005 of 40.08.

4. $3.4 \div 28$; $.004 \div 4$; $10.06 \div 5$; $80.008 \div 16$.

5. $60.012 \div 30$; $100.01 \div 50$; $30.006 \div 90$; $160.02 \div 800$.

6. $6 \div .2$; $6 \div .002$; $10 \div .05$; $50 \div .001$.

7. $80 \div .16$; $800 \div .016$; $48 \div 1.6$; $32 \div .016$.

8. Find the following fractional parts of \$1: $\frac{3}{8}$; $\frac{3}{5}$; $\frac{7}{8}$; $\frac{1}{6}$; $\frac{5}{6}$; $\frac{1}{12}$; $\frac{5}{12}$; $\frac{1}{16}$; $\frac{3}{16}$; $\frac{15}{16}$.

9. What part of \$1 is $37\frac{1}{2}¢$? $62\frac{1}{2}¢$? $75¢$? $66\frac{2}{3}¢$? $87\frac{1}{2}¢$?

10. How many pounds in $\frac{1}{4}$ cwt.? $\frac{3}{5}$ cwt.? $\frac{1}{5}$ T.? $\frac{3}{5}$ T.? $\frac{7}{5}$ T.?

11. What part of a ton is 600 lb.? 8.4 cwt.? 380 lb.?

12. 1 T. of coal will cost how many times as much as 4 cwt.? as 800 lb.? as 12 cwt. 50 lb.? as 80 lb.?

13. What part of a mile is 2250 ft.? 830 yd.?

14. What part of an acre is 12,000 sq. ft.? 1500 sq. ft.?

Find the amount of each of the following sales and the change for a ten-dollar bill:

15. $8\frac{2}{3}$ lb. of meat at $16¢$ a pound.

16. 12 oz. of cheese at $12¢$ a pound.

17. 400 lb. of coal at \$6.25 a ton.

18. 7 lb. 6 oz. of tea at $60¢$ a pound.

19. 65 lb. of mutton at \$10 a hundredweight.

20. 26 qt. of oil at $18¢$ a gallon.

21. $2\frac{1}{2}$ bu. berries at $8¢$ a quart.

22. 45 qt. 1 pt. of berries at \$4.00 a bushel.

23. If a man earns $\$1\frac{3}{4}$ in a day, how much can he earn in 2 weeks? in a month? in a year?

24. If a man can earn \$1 in $\frac{3}{4}$ of a day, how many dollars can he earn in 4 days? in a month?

25. How much does a piece of land cost if .9 of it cost \$1800?

26. How many yards of cloth at $16\frac{1}{2}¢$ a yard will be received for $84\frac{3}{4}$ bu. of potatoes worth $35¢$ a bushel?

27. What is $\frac{3}{4}$ of an acre of land worth at $\frac{3}{4}$ of a cent a foot?

Digitized by Google

1. If a year is counted as $365\frac{1}{4}$ days, instead of 365.242264 days, how great will the error be in 100 years?

2. A young man spent \$182.40 during his first term at college, which was $\frac{5}{12}$ of his year's allowance. What was his year's allowance?

3. A load of hay weighing $\frac{3}{4}$ of a ton is sold for \$12.50. What will 2 T. 4 cwt. cost at the same rate?

4. What will 4 oz. of cheese cost at 10¢ a pound? What will 8 lb. 3 oz. cost? 16 lb. 12 oz.?

5. If I get $2\frac{1}{2}$ yd. of cloth for 80¢, how much ought I to pay for $3\frac{1}{8}$ yd. at the same rate? How many yards can I get for \$5?

6. At $\$\frac{3}{8}$ a peck, how many bushels of apples can I buy for \$12? How much will 6 bu. 2 pk. cost?

7. A boy has 20¢ in his pocket, which is $\frac{1}{5}$ of what he has at home. How much has he in all?

8. A man's house expenses for a year are \$480, which is $\frac{3}{5}$ of what he earns. If he puts $\frac{1}{4}$ of what he earns in the bank, how long will it take him to save \$1000?

9. What must I pay for 2240 lb. of coal at \$6.50 a ton?

10. At $8\frac{1}{3}$¢ a yard, how many yards of cloth can be bought for \$100? for \$10? for \$1000?

11. At \$6.25 a ton, how many tons of coal can be bought for 180 bu. of potatoes at 75¢ a bushel?

12. If a boy earns $\frac{3}{4}$ of a dollar in 1 day, how much will he earn in a week (6 days)? in the month of May? How many days will it take him to earn \$12?

13. If a man earns \$14 a week, how much is that a day? How long will it take him to earn \$250? How much would he earn in a year, if he worked every weekday?

14. What will 42 eggs cost at 32¢ a dozen? What will 50 eggs cost at the same rate? 75 eggs?

15. How many eggs at 28¢ a dozen will pay for $4\frac{3}{8}$ lb. of beef at 21¢ a pound?

16. 3 men do $\frac{2}{3}$ of a piece of work in a week. How long will it take 1 man to finish it?

Digitized by Google

SECTION II.

MENSURATION.

Oral and Written Exercises.

1. Reduce to inches: $8\frac{1}{4}$ ft.; $4\frac{2}{3}$ yd.; 3 yd. 1 ft.; 2 yd. 9 in.

2. Reduce to feet: 30 in.; $6\frac{1}{2}$ yd.; 8 yd. 2 ft.; 2 rd.; $3\frac{1}{2}$ rd.; 2 rd. 3 yd.; 5 rd. 10 ft.; 6 yd. 9 in.; $\frac{1}{2}$ mi.; 1 mi. 5 rd.

3. Reduce to yards: $8\frac{1}{2}$ ft.; 100 in.; 12 ft. 8 in.; 5 rd.; $8\frac{1}{2}$ rd.; 6 rd. 3 yd.; 9 rd. 8 ft.; $\frac{3}{4}$ mi.

4. Reduce to rods: 66 ft.; 80 ft.; 480 ft.; 100 yd.; 80 yd. 1 ft.; $2\frac{1}{2}$ mi.; 3 mi. 24 rd.; 1. mi. 20 rd. 4 yd.

5. Reduce to miles: 400 rd.; 1000 rd.; 500 ft.; 2000 ft.; 50 yd.; 10,000 ft.; 6000 yd.

6. Reduce to higher denominations: 42 in.; 86 in.; 194 in.; 78 ft.; 100 ft.; 1000 ft.; 3846 ft.; 3000 yd.

7. The wheel of a wagon 9 ft. 8 in. in circumference turns round 40 times in going from one place to another. What is the distance in rods? If it turns round 1860 times, what is the distance in miles?

8. How many paces, each 32 in. long, will one take in going $\frac{3}{4}$ of a mile?

9. How many paces, each .8 yd. long, around a rectangular piece of land 142 ft. long and 100 ft. wide?

10. At 14¢ a yard, what will it cost to inclose with a fence a lot of land $5\frac{1}{2}$ rd. square?

11. If a man takes 120 steps a minute, and each step is 30 in. long, what is his rate of walking per hour? How long at this rate will he be in walking 20 miles?

12. How many days, hours, and minutes would it take a train moving at the rate of 25 miles an hour to go from the earth to the moon, a distance at its nearest point of 225,000 miles?

Digitized by Google

1. A Gunther's chain is sometimes used by surveyors. It consists of 100 links each 7.92 inches long. How many feet long is the chain? How many rods long? How many chains make a mile?

2. How many rods long is a piece of land that is 25 ch. long? 8 ch. 60 li.?

3. The length of a certain road is 60 ch. 18 li. What part of a mile long is the road?

4. Instead of the Gunther's chain, surveyors frequently use a steel ribbon 100 ft. long with markings at tenths and hundredths of feet. How many rods, feet, and inches long is a road 86.38 ft. long?

5. The four sides of a field measure 138.60 ft., 68.48 ft., 138.60 ft., 72.36 ft. What will it cost to inclose it with a fence at 10¢ a yard?

6. In 1 fathom there are 6 feet. How many feet in $8\frac{1}{2}$ fathoms? How many fathoms in 100 ft.?

7. A cable length is 120 fathoms. How many feet?

8. Two vessels are 10 cable lengths apart. How many miles are they apart?

9. Show by diagram how you find the area of a rectangle.

10. Show by diagram how many square inches make 1 sq. ft.

11. Show by diagram how many square feet make 1 sq. yd.

12. Show by diagram how many square yards make 1 sq. rd.

13. Show by diagram how many square feet make 1 sq. rd.

14. How many square rods in 1 A.? How many square chains?

15. How many rods long is a square mile? How many square rods in it? How many acres?

16. How many square feet in an acre? in $\frac{1}{2}$ A.? in $\frac{3}{4}$ A.?

17. How many square feet in 18 sq. rd. 180 sq. ft.?

18. How many square inches in 4 sq. yd. 6 sq. ft. 28 sq. in.?

19. How many acres in 200 sq. rd.? in 1000 sq. rd.? 20 sq. rd.?

20. What part of an acre is 1200 sq. yd.? 20,000 sq. ft.?

21. What part of an acre is 62 sq. rd. 146 sq. ft.?

22. What will 32,460 sq. ft. of land cost at $400 an acre?

23. I bought $1\frac{3}{4}$ A. of land and cut it up into 12 house-lots. How many square feet in each lot? If the land cost me $500 an acre, and I sold it for $2\frac{1}{2}$¢ a square foot, what was my profit?

Digitized by Google

1. A piece of land 18 rd. 10 ft. long and 180 ft. wide is worth what at 8¢ a square foot? How many yards of fence will it take to inclose the lot?

2. A square mile of land in the form of a square is how many rods long and wide? How many acres in it? What other dimensions may a piece of land have which contains 1 sq. mi.?

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

3. Townships in Western States are 6 miles square. How many sections, each one mile square, in a township? Copy the above plan of township, and locate section 17; section 26. How long and wide is each section? How many acres in each section? Each section may be divided into half-sections or quarter-sections. Locate on the plan the southeast quarter of section 21. How many rods wide is it? How many acres does it contain? How many acres in a half-section?

4. I bought the north half of section 12 at $12 an acre. What did it cost? I sold one-half of my land (northeast quarter) for $15 an acre. What did I sell it for? How much will it cost to fence the remaining portion at 80¢ a rod?

Digitized by Google

1. If the top of a desk 16 in. long contains 160 sq. in., how wide is it? (Draw plan.)

2. How long is a room that is 20 ft. wide, and contains 480 sq. ft.? (Draw plan.)

3. A rectangular piece of land containing 1 acre is 28 rd. long. How wide is it?

4. What must be the length of a piece of cloth $\frac{2}{3}$ of a yard wide to contain 26 sq. yd?

5. How many yards of carpeting 27 in. wide will it take to carpet the floor of a room 18 ft. long and 12 ft. wide? In what way must the carpet be laid to have no waste?

6. How many yards of carpeting 30 in. wide will it take to cover the floor of a room 12 ft. 6 in. wide and 16 ft. 4 in. long, if the carpet is laid lengthwise? How many yards if laid the other way? (Draw plan.)

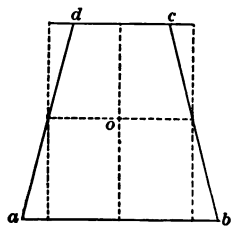
7. How wide must a board 4 ft. long be to contain 3 sq. ft.? to contain 1 sq. ft.? to contain 90 sq. in.?

8. A "course" or layer of 50-inch boards is 14 ft. 6 in. long. How many square feet in it? How many of such courses will it take to make 1 M. sq. ft.?

9. A board 10 ft. long, 1 ft. wide, and 1 in. thick, has how many square feet? If it were 2 in. thick, how many feet board measure would there be in it?

10. How many feet board measure in a plank 12 ft. long, 16 in. wide, and 2 in. thick?

11. A timber measures 18 ft. long, 6 in. wide, and 4 in. thick. How many feet board measure in it?



12. Find the average width of a piece of board 8 in. wide at one end and 4 in. wide at the other. This figure representing the board is drawn to what scale? How long is the board? How wide at *o*? Show by cutting paper that the size of rectangle shown by dotted lines is equal to that of the board. How many square feet in the board?

Digitized by Google

1. What is the average width of a 60-inch board 4 in. wide at one end and 6 in. wide at the other? (Draw plan and find contents.)

2. What is the average width of a board 6 in. wide at one end and 9 in. wide at the other? How many square feet in the board if it is 7 ft. 2 in. long?

3. How many square feet board measure in the following planks, each 3 in. thick? 1 plank 16 ft. long, 5 in. wide at one end and 8 in. wide at the other. 2 planks, each 18 ft. long, 8 in. wide at one end and 11 in. wide at the other.

4. Draw and name all kinds of polygons from triangle to decagon.

5. Draw, name, and describe four kinds of parallelograms.

6. Show by diagram how you find the area of a parallelogram: of a triangle; of any polygon.

7. What is the area of a triangle whose base is 8 ft. 3 in., and whose altitude is 6 ft. 6 in.? (Draw plan.)

8. What is the area of a parallelogram whose base is 6 rd. 14 ft., and whose altitude is 3 rd. 8 ft.?

9. What is the area of a piece of land in the form of a rhomboid 20 ft. long, the distance between the parallel sides being 8 ft.? (Draw plan to scale.)

10. The floor of a certain room is in the form of a trapezoid. The two parallel sides are 8 ft. and 12 ft. long, and the altitude is 10 ft. How many square yards of carpet will it take to cover it, no allowance being made for waste in cutting or laying? (Draw plan to scale.)

11. A court in the form of a rhombus whose sides are 40 ft. long and whose altitude is 32 ft. has an area of how many square yards?

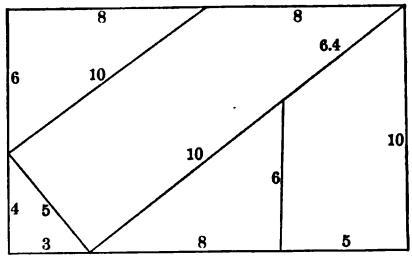
12. A rectangular lawn 24 ft. long, 16 ft. wide, has a walk 4 ft. wide extending around it on the outside. How many square feet in the walk? (Draw plan on scale of 8 feet to an inch.)

13. A square garden whose sides are 40 ft. long has a walk extending around it on the border 4 ft. wide. How many square feet in the walk? How many square yards in the rest of the garden?

14. Find the area of blackboard surface in your school-room.

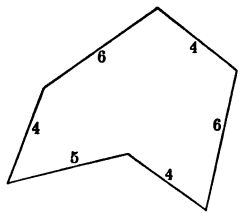
Digitized by Google

1. Find the area of each of the polygons included in the rectangle. Find the sum of the areas, and compare with the area of the rectangle. (Figures represent the number of yards.)



2. At the rate of 20¢ a yard, how much will it cost to inclose the whole lot with a fence?

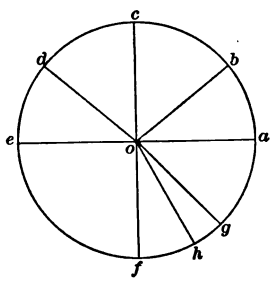
3. At 50¢ a square yard, how much will it cost to make a walk 6 ft. wide around the outside of the rectangle? How much would a walk of the same width cost around the inside of the rectangle?



4. This irregular polygon is drawn to a scale of $\frac{1}{8}$ of an inch to a foot. By diagonals and measurements find its area in square feet. Draw a similar polygon to another scale, and find area.

5. Draw four sides of an irregular pentagon in the proportion of 2, 3, 4, and 5. Join ends, and find the length of the fifth side. Find the area.

6. What is the circumference of this circle? diameter? radius? Point out a right angle; an obtuse angle; an acute angle; an arc.



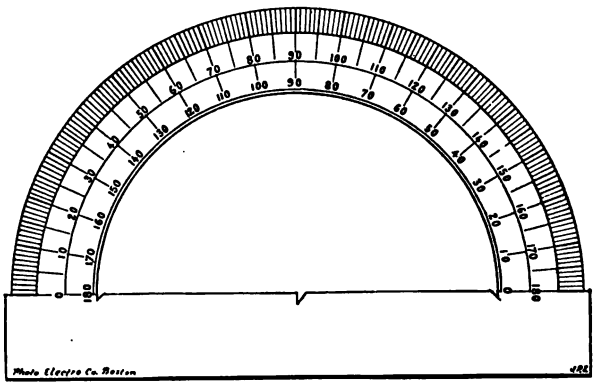
7. For purposes of measurement the circumference of a circle is divided into 360 parts called degrees (°). How many degrees in a semi-circumference? How many degrees in the arc *ac*? in the arc *ag*? in the arc *fg*? Through how many degrees does the hour-hand of a clock move in 12 hours? in 6 hours? in 3 hours? in 2 hours? Through how many degrees does the minute-hand of a clock move in 30 minutes? in 15 minutes? in 5 minutes?

Digitized by Google

1. Point out in the circle (page 14) two equal arcs. What can you say of the angles at the centre opposite these arcs? Point out an angle of 90°; of 45°.

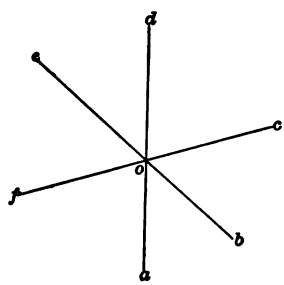
2. The arc *ah* is $\frac{1}{8}$ of the circumference. What can you say of the angle *aoh*? With compasses or other measure mark off $\frac{1}{8}$ of the circumference of a circle, and join centre with ends of the arc. What angle is made by the lines at the centre? In the same way find angle of 90°; 60°; 45°; 30°.

3. From cardboard or stiff paper cut out and mark degrees of a protractor similar to the following:



4. Draw ten different angles; estimate the value of each in degrees; then measure with protractor, noting the difference between the estimated and measured values.

5. Measure each of the angles at *o*. Add the results. What ought the sum to be? Draw angles in the same way around a point, and measure.



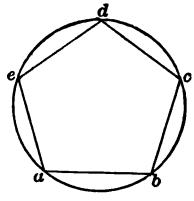
6. Measure the angles *aob* and *doe*. Compare. What other angles are equal? Draw angles of 60°; 40°; 20°; 80°; 140°; 75°.

7. Measure all the angles of a triangle, and find their sum; of any polygon.

Digitized by Google

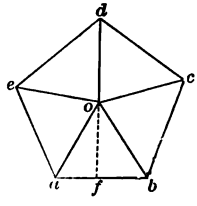
1. Draw a polygon having equal sides. This is called an equilateral polygon. Draw an equilateral pentagon; an equilateral octagon.

2. Draw a polygon having equal angles. This is called an equiangular polygon. Draw an equiangular triangle; an equiangular quadrilateral.



3. State why the polygon *abcde* is a regular pentagon. In constructing this pentagon, the circle was made first; then the points *a, b, c, d, e* were made. How? In the same way construct a regular hexagon; a regular heptagon; a regular octagon.

4. In the regular pentagon *abcde*, compare the number of angles at the centre *o* with the number of sides. What is the size of each angle at the centre *o*? How could you construct a regular pentagon from a given centre *o*? By the aid of a protractor, construct a regular hexagon; a regular heptagon; a regular octagon. Connect the centre with each angle of the regular polygon, and state how you can find the area of the polygon.



5. Find the area of the above regular pentagon, drawn on a scale of 12 feet to an inch.

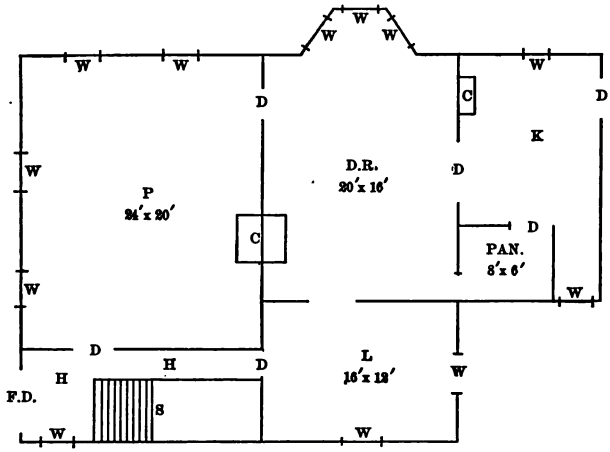
6. What is the area of a flower-bed laid out in the form of a regular hexagon, whose side is 10 ft., and perpendicular distance from centre to one side is 8.6 ft.?

7. Required the area of a piece of land in the form of a regular octagon, each side of which is 80 ft., and perpendicular distance from centre to one side is 122.4 ft.

8. What is the area of a piece of land in the form of an equilateral triangle, each of whose sides is 18 rd., and perpendicular distance from centre to one side is 20 rd. 2 ft.?

9. Draw to convenient scale a regular octagon, each of whose sides is 24 ft. Estimate by measurement the perpendicular distance from centre to side, and find area.

Digitized by Google



Drawn on a scale of ¼ in. to 4 ft. Measure for distances not given.

P.	= Parlor.	Pan.	= Pantry.
D. R.	= Dining-room.	F. D.	= Front door, 5 ft. wide, 8 ft. high.
L.	= Library.	D.	= Doors, 4 ft. wide, 7½ ft. high.
K.	= Kitchen.	W.	= Windows, 3½ ft. wide, 5½ ft. high.
H.	= Hall.	C.	= Chimneys.
S.	= Stairs, 5 ft. wide.	The walls are 8½ ft. high.	

1. At the rate of $4 a square foot on the ground floor, how much will it cost to build this house?

2. In carpeting the parlor with carpet 27 in. wide, in which direction can it be laid without cutting or doubling under? How many yards will it take to cover the floor?

3. How many yards of carpeting 27 in. wide will it take to carpet the hall? How many the dining-room? How many the library?

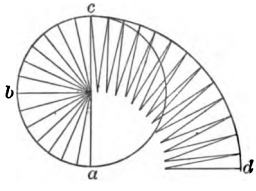
4. How many square yards of plastering in the ceiling of the parlor? of the dining-room? of the library? of the kitchen?

5. How many square feet of paper will it take to paper the walls of the parlor? How many rolls of paper will it take, if each roll is 8 yd. long and 1 ft. 6 in. wide, with a loss of 2½ yd. for matching?

6. The dining-room has a wainscot 3 ft. high. How many square feet in it? How many square feet of plastering in the walls of the room? How many rolls of paper will it take to paper the walls, the rolls being 24 ft. long, 18 in. wide?

Digitized by Google

1. Cut paper in the form of a circle; divide it into minute triangles whose vertices are at the centre, as shown in the figure.



If the number of triangles should be indefinitely increased, what can you say of the relative length of side and altitude of triangle? The sum of bases constitutes what? How then may we find the area of a circle? Another way to find the area is to cut the circle into 24 or more triangles, and put them together in the form of a rectangle.

2. To find the area of a circle, multiply the circumference by what?

3. What is the area of a circle whose circumference is 62.8 ft. and whose radius is 10 ft.?

4. A circular piece of land has a circumference of 262 ft. and a diameter of 83.4 ft. What is the area in square rods? What part of an acre?

5. Find the area of a circle whose diameter is 35 ft. and whose circumference is $3\frac{1}{7}$ times as long.

6. Measure carefully the circumference and diameter of any circle, and divide one by the other. Compare this quotient with that found by dividing the circumference by the diameter of other circles. How many times the length of the diameter do you find the circumference? How near $3\frac{1}{7}$? A more accurate quotient is 3.1416.*

7. What is the circumference of a circle whose diameter is 10 ft.? 100 ft.? 1000 ft.?

8. What is the area of a circle whose diameter is 20 ft.? 40 ft.?

9. What is the diameter of a circle whose circumference measures 10 ft.? 50 ft.? $8\frac{2}{3}$ yd.?

10. What is the area of a circle whose diameter is 18 in.? $3\frac{1}{2}$ ft.?

11. A wheel whose diam. is 4 ft. turns how many times in a mile?

* A still more accurate quotient is 3.14159265358979323 8. Can you read this number? For all practical purposes, 3.1416 is near enough, or even $3\frac{1}{7}$. This ratio of the circumference to diameter is represented by the Greek letter π (pi).

Digitized by Google

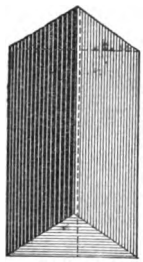
1. How many faces has a cube, and what is the shape of each face? How can you find the area of the surface of a cube?

2. What is the area of the surface of a cube whose sides are 8 in. long?

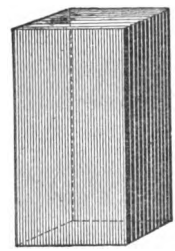
3. How many square feet of tin will it take to line a box whose base is 15 in. square and whose height is 15 in.?

4. How many square inches in the outside surface of a box 8 ft. long, 4 ft. 6 in. wide, and 2 ft. high?

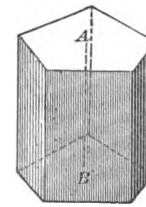
5. At 25¢ a square foot, what will it cost to line the sides and bottom of a cubical tank whose sides are 12 ft.? How many gallons of water will it hold? (231 cu. in. in a gallon.)



Triangular Prism.



Quadrangular Prism.



Pentagonal Prism.

6. In what respects are these prisms alike? In what respect do they differ? What is a prism? How are prisms named? What is a triangular prism? What is a hexagonal prism?

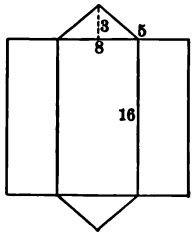
7. The bases of the triangular prism above are in the form of an equilateral triangle, each side being 5 in. long. The height of the prism is 9 in. How can you find the area of the lateral faces or the convex surface of the prism?

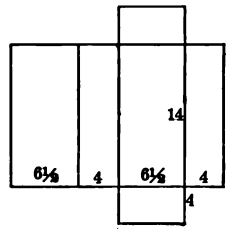
8. Find the convex surface of the quadrangular prism above, it being drawn to a scale of $\frac{1}{8}$ of an inch to an inch. What is the area of the base? What are the cubic contents of the prism?

9. Find the convex surface of the pentagonal prism, it being reduced 16 fold. Estimate by measurement the area of base and cubic contents.

Digitized by Google

1. Cut from paper slips of the size in inches indicated by the figures; fold in form of prisms, and get the convex surface. Find the area of the bases. Find the cubic contents of each prism.





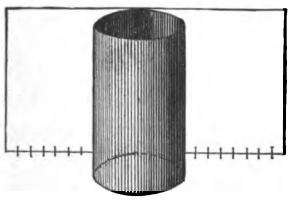
2. What is the volume of a triangular prism whose altitude is 8 ft., and the area of whose base is 448 sq. in.?

3. Draw a regular hexagon whose sides are 10 in. long. Find by measurement the square contents. This hexagon is the base of a prism 15 ft. high. What is its lateral or convex surface? What is its volume?

4. What is the lateral surface of a regular pentagonal prism whose sides are 4 ft. and whose height is 12 ft.? The perpendicular distance from the centre of base to one side is 2.75 ft. What is the volume of the prism?

5. A cistern in the form of a quadrangular prism is 10 ft. 6 in. long, 8 ft. 3 in. wide, and 6 ft. deep. How many square feet of lead will be required to line the sides and bottom of it? How many gallons of water will it hold, a gallon measuring 231 cu. in.?

6. Describe a cylinder. How can you find the convex surface of a cylinder? How the surface of the bases?



7. How can you find the volume of a cylinder?

8. Find the convex surface of a cylinder, the circumference of whose bases is 18 in. and whose altitude is 2 ft. What is the surface of one of the bases? What is the volume of the cylinder?

9. What are the cubic contents of a round lead-pencil $6\frac{1}{2}$ in. long, having a diameter of $\frac{1}{4}$ of an inch? How many square inches of surface has it?

Digitized by Google

1. How much will it cost to dig a well 25 ft. deep and 4 ft. in diameter at $3.50 a cubic yard?

2. A cylindrical tank is 16 ft. deep and 8 ft. in diameter. How much will it cost to cement the sides and bottom of it at 25¢ a square foot?

3. How many cubic inches of iron will it take to make 100 yd. of wire $\frac{1}{2}$ in. thick?

4. How many cubic inches in a block of stone 18 in. long, 10 in. wide, and 10 in. thick? How thick would it have to be to contain 900 cu. in.?

5. What must be the length of a brick 4 in. wide and 2 in. thick to contain 64 cu. in.?

6. A room containing 960 cu. ft. is 12 ft. long and 8 ft. wide. How high is it?

7. A pile of wood 4 ft. wide and 16 ft. long must be how high to contain a cord?

8. How high must a box 6 ft. long, 4 ft. wide, be to contain 4 cu. yd.? (All measurements inside.)

9. A reservoir 30 ft. long and 20 ft. wide must be how deep to hold 10,000 cu. ft. of water?

10. What length of wire $\frac{3}{4}$ in. in diameter can be made from 1 cu. ft. of iron?

11. How many square yards in a floor 10 ft. long, 8 ft. wide?

12. What will it cost to pave a cellar 16 ft. 4 in. long by 12 ft. 3 in. wide at 80¢ a square yard?

13. How many cubic feet of stone in a rectangular block 18 in. square at the end and 3 ft. 8 in. long?

14. How many cubic feet of loam will it take to cover an acre of ground, if it is spread 1 in. thick?

15. A board fence 5 ft. high incloses a square lot of land measuring 32 ft. on a side. How many square feet of boards in the fence? At $15 per M., how much will the boards cost? At 12¢ a running yard, how much will it cost to build it?

16. How many square yards of paper will be required to cover the side of a room 18 ft. 3 in. long and 8 ft. 6 in. high?

Digitized by Google

1. How many square yards in the walls of a room 18 ft. by 10 ft. and 9 ft. high? If there are 4 windows, each 4 ft. 6 in. by 3 ft., and 2 doors, each 7 ft. 3 in. by 4 ft., how many square yards of plastering in walls and ceiling? How many yards of carpet 30 in. wide will it take to cover the floor?

2. What is the combined length of all the walls of a room that is 12 ft. long and 8 ft. wide? If the walls are 8 ft. high, how many square feet in the walls?

3. How many square feet in the walls of a room 15 ft. long, 12 ft. wide, and 9 ft. high? How many square yards?

4. How many square yards of paper will it take to cover the walls of a room 18 ft. long, 10 ft. wide, and 8 ft. high, allowance to be made for 3 windows, each 5 ft. by 4 ft., and 2 doors, each 7 ft. by 5 ft.?

5. A room is 12 ft. 6 in. long, 9 ft. wide, and $7\frac{1}{2}$ ft. high. It has 2 windows, each 5 ft. 6 in. by 3 ft. 6 in., and 1 door 7 ft. high and 4 ft. wide. How many rolls of paper will it take to paper the walls of the room, if each roll is 24 ft. long and 18 in. wide?

6. Find the number of square yards in the walls and ceiling of your school-room, allowing for windows and doors.

7. If there were a mop-board 9 in. wide around your school-room, how long would it be? How many square feet of wall would it cover?

8. A floor 18 ft. long, 12 ft. wide, has a painted border 2 ft. wide. How many square feet in the border? How many square yards of the floor are unpainted?

9. A grass-plot 40 ft. long, 24 ft. wide, has a walk around the outside of it 2 ft. wide. How many square feet in the walk? How much will it cost to inclose the plot and walk with a fence at 15¢ a yard?

10. How many yards of carpet $\frac{5}{8}$ of a yard wide to cover a floor containing 15 sq. yd., no loss in laying or matching?

11. How many yards of carpet 27 in. wide will it take to cover a floor 18 ft. by 10 ft.? To have no loss in laying the carpet, which way should it be laid?

Digitized by Google

1. How many feet of lumber (board feet) are there in a plank 12 ft. 6 in. long, 8 in. wide, and $2\frac{1}{2}$ in. thick?

2. Find the number of board feet in a two-inch plank 15 ft. 3 in. long, 9 in. wide at one end and 6 in. wide at the other end.

3. How many feet of lumber in a stick of timber 18 ft. long and 8 inches square?

4. How many feet of lumber will it take to make a sidewalk 16 rd. 8 ft. long, 6 ft. 6 in. wide, the planks to be $1\frac{1}{2}$ in. thick? What will the lumber cost at \$16 per M., board measure?

5. Find the number of board feet in the following: 18 joists, each 16 ft. by 8 in. and $2\frac{1}{2}$ in. thick; 6 beams, each 18 ft. 6 in. long and 8 in. square; 42 inch-boards, each 14 ft. 3 in. long and 7 in. wide. What will this lumber cost at \$15 per M., board measure?

6. How many loads (cubic yards) of loam will be required to spread 4 in. deep over a garden 48 ft. long, 20 ft. 6 in. wide?

7. How many loads of gravel will be required for a road 1 mile long, if it is spread 12 ft. wide and 8 in. deep?

8. What is the value of a lot of land in the form of a right-angled triangle, the base being 48 ft. and the perpendicular 98 ft., at 16¢ per square foot?

9. How many pailfuls of milk will it take to make a gallon, the pail being 5 in. in diameter and 4 in. deep?

10. How many bushels of corn can be put into a bin which is 9 ft. long, 4 ft. wide, and 6 ft. high, reckoning the bushel to measure $1\frac{1}{4}$ cu. ft.? How many by actual measurement of the bushel? How many bushels of potatoes can be put into the same bin, the heaped measure containing about $1\frac{1}{4}$ cu. ft.? How many tons, etc., of coal can be put into the bin, if a ton contains 40 cu. ft.?

11. A circular reservoir 40 ft. in diameter is filled with water 6 ft. deep. How many gallons will be drawn off in settling the water of the reservoir 6 inches?

12. How many rods of fence will be necessary to inclose a circular field whose diameter is 180 ft.? What is the area of the field?

Digitized by Google

1. How deep must wheat be in a bin 8 ft. square to measure 100 bushels?

2. How high must a circular cistern be to contain 500 gallons of water, if its base has an area of 12 sq. ft.?

3. From a point A to a point B east is 8 ft.; from B to a point C south is $4\frac{1}{2}$ ft.; from C to a point D west is 8 ft.; from D to the point A north is $4\frac{1}{2}$ ft. Draw plan to scale and find area.

4. From a point A in a room to a point B east is 6 ft.; from B to a point C south is 3 ft.; from C to a point D east is $3\frac{1}{2}$ ft.; from D to a point E south is $5\frac{1}{2}$ ft.; from E to a point F west is $9\frac{1}{2}$ ft.; from F to the point A is $8\frac{1}{2}$ ft. Draw plan to scale and find the area.

5. From any point A, and to the right, draw a line $1\frac{1}{4}$ in. long to B; from the point B, at right angles to the line AB, draw downward a line $\frac{1}{2}$ in. long to C; from the point C, at right angles to the line BC, draw to the right a line $\frac{3}{4}$ in. long to D; from the point D, at right angles to the line CD, draw downward a line $1\frac{3}{4}$ in. long to E; from the point E, at right angles to the point DE, draw to the left a line 2 in. long to F; join AF. Letting this plan represent a lot of land drawn on a scale of $\frac{1}{8}$ of an inch to 1 rod, find the cost of fencing the lot at 15¢ a yard. Find the cost of the lot at $4\frac{1}{2}$¢ a square foot.

6. From any point as A draw a horizontal line $1\frac{3}{8}$ in. long to B; perpendicular to AB draw downward a line $1\frac{1}{4}$ in. long to C; perpendicular to BC draw to the left a line 2 in. long to D; join AD. From this plan of a garden drawn on a scale of $\frac{1}{4}$ of an inch to 1 rod, make problems in regard to the perimeter and area. Draw plans of beds and walks, and make problems about them.

7. Draw the plan of a field of any shape to a given scale. Make and perform problems in respect to (*a*) fencing the entire field; (*b*) cost of the field at a given amount per acre; (*c*) dividing the field into lots; (*d*) area and price of each lot at a given amount per square foot.

8. Measure by tape-line or paces any lot of land in the neighborhood. Draw to scale and make problems.

Digitized by Google

SECTION III.

DENOMINATE NUMBERS.

1. Reduce to pints: 3 gal.; 2 gal. 1 qt.; 6 gal. 1 pt.; 18 gal. 3 qt. 1 pt.; 40 gi.; 100 gi.; 16 qt. 3 gi.

2. Reduce to gills: 4 qt.; 3 pt.; 2 qt. 1 pt.; 3 gal.; 4 gal. 1 qt.; 3 gal. 1 pt.; 6 gal. 2 qt.; 1 pt. 3 gi.

3. Reduce to quarts: 6 gal.; 8 gal. 2 qt.; 30 pt.; 60 gi.; 3 gal. 1 pt.; 6 pt. 3 gi.; 4 gal. 3 gi.; 200 gi.

4. Reduce to gallons: 12 qt.; 48 pt.; 60 gi.; 3 qt. 1 pt.; 8 qt. 1 pt. 2 gi.; 2 qt. 1 pt. 3 gi.

5. How many pints and gills in 21 gi.? How many quarts and pints in 11 pt.?

6. Reduce to higher denominations: 12 gi.; 18 pt.; 17 gi.; 21 pt.; 12 qt.; 37 qt.; 76 gi.; 83 pt.; 141 qt.; 631 gi.

7. Reduce to pints: 3 pk.; 4 bu.; 2 bu. 5 pk.

8. Reduce to pecks: 8 bu.; 24 qt.; 63 qt.; 131 qt.

9. Reduce to bushels: 32 pk.; 128 qt.; 128 pt.; 300 qt.; 127 pk.; 21 pk. 3 qt.; 80 qt. 1 pt.; 68 qt. 1 pt.

10. Reduce to higher denominations: 17 qt.; 29 pt.; 43 qt.; 86 pk.; 630 qt.

Add:

11.

gal.	qt.
4	1
3	3

12.

gal.	qt.
6	3
2	3

13.

gal.	qt.	pt.
8	2	3
1	3	1

14.

gal.	qt.	pt.
3	2	6
1	2	2

15. 8 gal. 3 qt. + 2 gal. 3 qt.; 7 gal. 1 pt. + 3 qt. 1 pt.

16. 2 gal. 3 qt. 1 pt. + 4 gal. 1 pt.; 6 qt. 1 pt. + 3 gal. 2 qt.

17. 5 bu. 6 qt. + 3 bu. 6 qt.; 4 bu. 3 pk. 5 qt. + 2 bu. 6 qt.

18 2 bu. 3 pk. + 1 bu. 2 pk. 6 qt.; 3 pk. 7 qt. + 4 bu. 6 qt.

Digitized by Google

Subtract:

1.		2.		3.			4.		
gal.	qt.	gal.	qt.	bu.	pk.	qt.	bu.	pk.	qt.
4	0	6	1	4	3	2	6	0	3
2	1	2	3	2	1	6	2	3	4

5. 6 gal. 1 pt. — 2 gal. 2 qt.; 4 gal. 1 qt. — 2 gal. 1 pt.
6. 8 gal. — 2 gal. 1 qt. 1 pt.; 6 gal. 1 pt. — 5 qt. 1 pt.
7. 5 bu. 1 qt. — 2 bu. 3 qt.; 6 bu. 1 pk. — 2 bu. 6 qt.
8. 12 bu. — 3 pk. 5 qt.; 1 bu. 1 qt. — 3 pk. 5 qt.
9. Add 2 bu. 3 pk. to 50 pk. (Answer in bushels.)
10. Add 1 bu. 6 qt. to 3 pk. 4 qt. (Answer in quarts.)
11. From 10 gal. take 2 gal. 3 qt. (Answer in gallons.)
12. From 3 gal. 1 pt. take 3 qt. (Answer in quarts.)
13. From 10 bu. take 4 bu. 3 pk. 6 qt. (Answer in bushels.)
14. From a barrel of kerosene oil containing 45 gal. there was sold 18 gal. 1 qt. 1 pt. How much was left?

Multiply:

15.		16.		17.			18.		
gal.	qt.	gal.	qt.	bu.	pk.	qt.	gal.	qt.	pt.
6	1	4	3	4	2	3	2	0	1
	3		4			6			8

19. If 1 can holds 3 gal. 3 gi. of milk, how much can be put into 8 cans? 13 cans? 26 cans?

What is the cost of:

20. 3 pk. 2 qt. of corn at 60¢ a bushel?
21. 2 bu. 3 qt. of berries at 50¢ a peck?
22. 5 gal. 1 pt. of oil at 25¢ a gallon?
23. 6 gal. 1 pt. of vinegar at 6¢ a quart?
24. 25 bu. 3 pk. 6 qt. of wheat at 75¢ a bushel?
25. 3 bu. 5 qt. of beans at 90¢ a peck?
26. 5000 qt. of milk at 15¢ a gallon?

Digitized by Google

Divide:

1.		2.		3.			4.	
gal.	qt.	bu.	pk.	gal.	qt.	pt.	bu.	qt.
4)6	2	6)3	6	8)4	0	1	5)1	3

5. 56 gal. 1 qt. of milk is put in equal quantities in 9 cans. How many gallons and quarts in each can?

6. 18 bu. 3 pk. of grain is distributed equally among 10 persons. How much does each receive?

7. If 2420 bu. of grain are raised on 100 acres, what is the average yield per acre?

8. Reduce to lower denominations: $\frac{3}{4}$ bu.; $\frac{7}{8}$ gal.; $\frac{5}{6}$ bu.; $\frac{5}{8}$ gal.; $\frac{1}{12}$ qt; $\frac{1}{15}$ pk.

9. Reduce to lower denominations: .45 bu. .8 gal.; .75 pk.; .875 qt.; .625 bu.; 4.375 gal.

10. What part of a bushel is 3 pk. 2 qt.? $6\frac{1}{2}$ qt.?

11. What part of a gallon is 3 qt. 1 pt.? $2\frac{1}{4}$ qt.? $1\frac{1}{8}$ pt.?

12. At 40¢ a gallon, what will $3\frac{3}{4}$ qt. of molasses cost?

13. What will 3 bu. of corn cost at the rate of $2\frac{1}{2}$ pk. for 25¢?

14. How many gallons in $3\frac{1}{2}$ barrels, each barrel containing $31\frac{1}{2}$ gal.?

15. What part of a barrel which contains $31\frac{1}{2}$ gal. is $4\frac{1}{2}$ gal.? 18 gal. 3 qt.? 27 gal. 1 qt.?

16. At $4.80 a barrel (42 gal.), what will 16 gal. 2 qt. of kerosene cost? 118 gal. 3 qt.?

17. 1 bushel contains 2150.42 cu. in. How many cubic inches in 1 quart dry measure?

18. 1 gallon contains 231 cu. in. The quart of dry measure is how many cubic inches larger than the quart liquid measure?

19. If 20 bu. of berries are sold by the liquid quart, how many more quarts are sold than would be sold by the proper measure?

20. From $\frac{7}{8}$ of a bushel of cranberries there was sold 3 pk. 2 qt. What is the remainder worth at 12¢ a quart?

21. From 18.8 bu. of corn there was sold 6 bu. 3 pk. 2 qt. What is the remainder worth at 55¢ a bushel?

Digitized by Google

118.94.700. BK6

T5
7361

HARVARD UNIVE

LIBRARY OF TH

Department of E

COLLECTION OF TEX
Contributed by the P

TRANSFE
TO

Digitized by Google

Digitized by Google

1. Name the coins of United States money. Give the value of each. How many dollars in a roll of 20 dimes? in a roll of 20 quarters of a dollar? in 10 rolls of cent pieces, each roll having 20 pieces? How many rolls of quarters, 20 in a roll, are there in $5? How many rolls of dimes, 20 in a roll, are there in $10?

2. The English coins are the sovereign or pound, half-sovereign, crown (5 shillings), half-crown, florin (2 shillings), shilling, the sixpenny, fourpenny, threepenny, and penny pieces, and the farthing. There are — farthings (far.) in a penny, — pence (*d.*) in a shilling (*s.*), and — shillings in a pound (£).

3. How many farthings in six pence? in 1 shilling?

4. How many pence in 20*s.*? in 12*s.* 6*d.*?

5. How many pence in 48*s.* 8*d.*? in £1? in £2 6*s.*? in £4 16*s.* 8*d.*? in £5 8*d.*?

6. How many shillings in £4? in £8 12*s.*?

7. How many shillings in 24*d.*? in 120*d.*? in 192*d.*?

8. How many shillings and pence in 58*d.*? in 128*d.*?

9. Reduce to pounds: 240*s.*; 240*d.*; 362*s.*; 1864*d.*

10. £5 16*s.* 8*d.* is written also £5 16/8. In the same way write £4 8*s.* 4*d.*

11. Reduce to pence: £1 14/6; £6 12/; £4 /3.

12. Reduce to pounds and decimal of a pound: 1643*s.*; 1062*d.*; 180*s.* 10*d.*

13. Add £6 17*s.* to £12 10*s.*

Add:

14.

£	*s.*	*d.*
8	14	8
6	12	5

15.

£	*s.*	*d.*
17	0	5
13	15	9

16.

£8	14/3	
£2	0/10	

17.

£6	15/
£8	12/5

18. Add £2 18/6, £4 13/, £8 0/10, £14 10/8.

19. From £4 12*s.* take £2 8*s.*; take £1 15*s.*

20. From £3 8*d.* take £1 5*s.* 3*d.*; take 15*s.* 6*d.*

21. From £9 take £3 6*s.* 3*d.* + £1 18*s.* 10*d.*

22. From £20 there was taken at one time £8 4/6, and £6 3/8 at another time. What sum was left?

Digitized by Google

1. Multiply £8 6*s.* by 4; by 6; by 12.

2. Multiply £6 8*d.* by 20; by 15; by 32.

3. What is the cost of 8 bicycles at £16 8*s.* apiece?

4. At 10*s.* 6*d.* a yard, what cost 8 yards of cloth?

5. If a cabin passage from Liverpool to New York is £15 10*s.*, and passage by steerage is £4 8*s.*, how much more must be paid for 4 cabin tickets than for 12 steerage tickets?

6. Divide £18 by 4; by 10; by 20; by 32.

7. Divide £8 10*d.* by 6; by 9; by 12; by 18.

8. If 3 suits of clothes cost £4 8*s.*, what is the average price of each suit? At the same price, what would 24 suits cost?

9. If I pay a pound a week for a room, what is the price per day? What for the month of March?

10. What part of a pound is 12*s.* 6*d.*? 138*d.*?

11. Reduce to lower denominations: £$\frac{7}{8}$; £.625; $\frac{5}{8}$*s.*

12. A pound English money is worth $4.866 United States money. Give the exact value in our money of 1 shilling; 1 penny; 1 farthing; a crown; a florin; a sixpence.

13. Give the exact value in United States money of £6 8*s.*; of £18 10*d.*; of £10 4*s.* 6*d.*

14. Give the exact value in English money of $24.33; of $1; of $8.20; of $16.50.

15. The rough estimate of a pound is $5, of a shilling is 25 cents, of a penny is 2 cents, and of a farthing is $\frac{1}{2}$ of a cent. Roughly estimate in United States money £6; £3 10*s.*; 8*s.* 6*d.*; £5 8*d.*; £12 12*s.*; £40 6*s.*

16. Roughly estimate in English money $15; $18; 75¢; $20.50; $7.80; $150; 35¢; $15.40.

17. Roughly estimate the value of a half-sovereign; a crown; a sixpence.

18. About how much in United States money is £15? £8 10*s.*? £30? £26 15*s.*? What is the difference between the rough estimate and the exact value of these sums?

19. What will 3 tickets to Liverpool cost in United States money at £17 10*s.* apiece, exchange at par?

Digitized by Google

1. The French franc (fr.), = 100 centimes (c.), is worth in United States money $.193. How many centimes is 5 fr. worth? 10 fr.? 20 fr.? How many francs is 300 c.? 680 c.? 1460 c.?

2. What is the value in United States money of 5 fr.? 20 fr.? 50 fr.? 6.50 fr.? 120.25 fr.? 10 c.? 2 c.?

3. What is the total value of the following coins: 20-franc piece, 5-franc piece, 10 centimes, 5 centimes, and 2 centimes?

4. The rough estimate of a franc is 20 cents of United States money. Roughly estimate the value of a 5-franc piece; 10-franc piece; 20-franc piece; 10 centimes.

5. Roughly estimate in United States money 600 fr.; 830 fr.; 100.50 fr.; 640.25 fr.

6. I bought 8 dozen pairs of gloves at 3½ fr. a pair. About how much in United States money did I pay for them? If the duty on the gloves was 134.4 fr., and exchange was at par, how much exactly did the gloves cost me?

7. How many francs can I get for $15.44? $9.264? $20? (Exchange at par.)

8. The German mark (M.), = 100 pfennigs (pf.), is worth in United States money $.238. How many pfennigs in 6 M.? 24 M.? 64.50 M.? How many marks in 600 pf.? 850 pf.? 1960 pf.?

9. What is the value in United States money of the following pieces of money: 10 M.? 20 M.? 5 M.? 2 M.? 20 pf.? 10 pf.?

10. The rough estimate of a mark is 25 cents of United States money. Roughly estimate the value of a 5-mark piece; of a 20-mark piece; of a 20-pfennig piece; of a 5-pfennig piece.

11. I bought in Germany a suit of clothes for 85 M., an umbrella for 8½ M., and a pair of shoes for 12.20 M. About how much in United States money did they all cost? How much exactly, exchange being at par?

12. If money is exchanged at par, what will be given in German money for $40? for $150? for $327.25?

13. By the United States standard of exchange, what part of a mark is a franc? What part of a pound? Change 500 fr. to marks; to pounds. Change £60 to marks.

Digitized by Google

1. For all common purposes Avoirdupois weight is used, in which — ounces (oz.) = 1 pound (lb.), — pounds = 1 hundredweight (cwt.) or cental, — hundredweight = 1 ton (T.).

2. For weighing gold and silver, Troy weight is used, in which — grains (gr.) = 1 pennyweight (pwt.), — pennyweights = 1 ounce, — ounces = 1 pound.

3. Apothecaries' weight and measure are used for prescribing and compounding medicines. Repeat the table of Apothecaries' weight; of Apothecaries' measure.

4. Reduce to ounces (Avoirdupois) : 8 lb. 6 oz.; 4 cwt. 10 lb.

5. Reduce to pounds : 8 T.; 3 T. 8 cwt.; 1000 oz.; 4 cwt. 24 lb.

6. Reduce to tons : 4500 lb.; 180 cwt.; 6 cwt. 80 lb.

7. Reduce to pounds (Troy) : 40 oz.; 163 oz.; 500 pwt.

8. Reduce to ounces (Troy) : 100 pwt.; 240 gr.; 6 lb. 10 pwt.

9. Reduce to grains : 8 pwt.; $2\frac{1}{2}$ oz.; 1 oz. 16 gr.

Add :

10.		11.		12.			13.		
lb.	oz.	cwt.	lb.	T.	cwt.	lb.	T.	cwt.	lb.
8	6	6	40	2	16	50	7	0	90
3	14	5	80	3	13	80	9	4	60

14.		15.			16.		17.		
oz.	pwt.	lb.	oz.	pwt.	℥	℈	ƒ℥	ƒ℥	♏
6	15	2	8	12	2	14	3	5	40
9	12	1	9	10	6	10	5	6	30

18. 8 cwt. 14 oz. + 90 lb. 15 oz.; 9 T. 60 lb. + 17 cwt. 48 lb. 12 oz.

19. 6℥ 4℥ + 3℥ 6℥ 2℈; 5ƒ℥ 2ƒ℥ + 6ƒ℥ 16♏.

Find the difference :

20.		21.			22.			23.		
T.	cwt.	T.	cwt.	lb.	lb.	oz.	pwt.	℔	℥	gr.
8	16	6	0	42	2	6	16	6	2	12
3	18	2	8	60	1	9	12	3	8	15

24. 6℥ 3℈ — 2℥ 15 gr.; 8 lb. 6 oz. — 10 oz. 4 dr. 2 sc.

25. 2 T. 16 cwt. — 1 T. 14 cwt. 40 lb.; 4 T. 60 lb. — 8 cwt. 40 lb.

Digitized by Google

Multiply :

1.		2.		3.			4.		
℥	ʒ	fʒ	ℏ	T.	cwt.	lb.	oz.	pwt.	gr.
6	5	6	20	3	0	40	9	15	12
	8		12			9			10

5. 8 cwt. 20 lb. 15 oz. × 24 ; 7 T. 80 lb. × 16.

6. 16ʒ 2ȝ 15 gr. × 18; 12 cong. 5 O × 12.

Divide :

7.		8.				9.		10.		
T.	cwt.	lb.	oz.	pwt.	gr.	℥	ʒ	fʒ	fʒ	ℏ
9)8	16	6)1	9	0	20	8)3	6	10)2	6	40

11. 7 T. 8 cwt. 40 lb. ÷ 15 ; 8 lb. 6 oz. 15 pwt. ÷ 20.

12. If I divide a load of hay weighing 1 T. 150 lb. into 4 equal piles, how many pounds will there be in each pile? What will each pile be worth at $1.50 a hundredweight?

13. If a dozen silver spoons weigh 3 lb. 9 oz. 6 pwt., what does each spoon weigh?

14. What part of a ton is 8 cwt. 40 lb.?

15. What part of a pound is 8 oz. 12 gr. of gold?

16. If I pay $103.20 for 8 cwt. 60 lb. of meat, what ought a ton to cost at the same rate?

17. At $6.50 a ton, what will 6 cwt. 30 lb. of coal cost?

18. If to a dose there are 20ℏ of medicine, how many fluid ounces and fluid drams are there in 30 doses?

19. If a silver dollar weighs 412 gr., what is the weight in pounds, etc., of 100 silver dollars? of 1000?

20. I buy 85 long tons of coal (2240 lb. = a long ton) for $425, and sell it at $5.40 a common ton. What is the profit?

21. How many pills of 2 grains each can be made from 6ʒ 2ȝ of quinine? How many from 1℥ 4ʒ?

22. How many silver spoons, each weighing 3 oz. 9 pwt., can be made from a bar of silver weighing 8 lb. 2 oz. 12 pwt.?

Digitized by Google

Review Drill Table in Weights and Measures.

	A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*	*H.*	*I.*
J.	2	12	40	120	1860	$\frac{1}{2}$	.8	$2\frac{3}{4}$	4.5
K.	6	15	60	240	3970	$\frac{3}{4}$	.6	$1\frac{3}{4}$	6.25
L.	3	10	32	360	4080	$\frac{5}{8}$	.25	$3\frac{1}{8}$	4.40
M.	4	13	78	146	5376	$\frac{5}{12}$	.75	$6\frac{4}{5}$	6.125
N.	1	6	46	418	4509	$\frac{7}{12}$	.05	$5\frac{5}{8}$	8.428
O.	9	8	52	724	6058	$\frac{8}{15}$	.125	$4\frac{6}{8}$	6.386
P.	8	11	73	636	3974	$\frac{17}{20}$	.375	$7\frac{7}{12}$	10.09
Q.	7	14	68	540	7008	$\frac{19}{30}$	.608	$3\frac{8}{15}$	18.005

Reduce:

1. *A* T. to lb.
2. *A* mi. to rd.
3. *A* A. to sq. ft.
4. *B* gal. to qt.
5. *A* bu. to qt.
6. *G* £ to *s.*
7. *H* oz. to gr.

How many:

8. A. in *E* sq. ft.?
9. T. in *E* lb.?
10. yd. in *F* mi.?
11. cd. in *E* cd. ft.?
12. gi. in *D* qt.?
13. ft. in *H* mi.?
14. qt. in *G* bu.?

Reduce to lower denominations.

15. *F* sq. mi.
16. *F* T.
17. *G* cwt.
18. *G* mi.
19. *H* gal.
20. *I* lb. (Troy).
21. *F* cu. yd.

In every line find the sum of:

22. *B* rd. and *C* rd.
23. *C* T. and *E* cwt.
24. *F* mi. and *H* rd.
25. *A* A. and *E* sq. rd.
26. *G* bu. and *I* pk.
27. *F* cu. yd. and *H* cu. ft.

In every column find the difference between:

28. *J* rd. and *K* rd.
29. *K* gal. and *L* qt.
30. *F* A. and *C* sq. rd.
31. *B* bu. and *C* pk.
32. *G* A. and *I* sq. rd.
33. *F* £ and *H s.*

34. Change *B* qt. dry measure to liquid measure.
35. What will *I* acres of land cost at *C* dollars an acre?
36. What will *H* tons of coal cost at $6.50 a ton?
37. What will *F* tons of flour cost at $6 a barrel?

Digitized by Google

1. Name the months that have 30 days. Name those that have 31 days. Which month has 28 days?

2. How many days in a common year? How many weeks and days? How many days in a leap year?

3. There are — seconds in a minute, — minutes in an hour, — hours in a day, and — days in a week.

4. If a man earns $1.75 every week-day, how much does he earn in a year? If his expenses are $1.58 a day, what does he save in a year?

5. How many months and days from August 13 to December 20? from December 20 to June 30? from June 30 to September 5?

6. A person born April 1, 1886, was how old May 30, 1893? How old will he be June 30, 1908?

7. What is the exact number of days from September 16, 1891, to October 20, 1892? to January 1, 1893? to November 16, 1899?

8. If a boy saves 8¢ a day every day from January 1, 1888, to September 15, 1899, how much will he have saved?

9. Give your age in years, months, and days; in exact number of days; in years and fraction of a year.

10. George Washington was born February 22, 1732, and died December 14, 1799. How old was he in years, months, and days?

11. Abraham Lincoln was born February 12, 1809, and died at the age of 56 yr. 2 mo. 3 da. What was the date of his death?

12. What was the age at death of the following persons?

Goethe, born Aug. 28, 1749; died March 22, 1832.
Longfellow, born Feb. 27, 1807; died March 24, 1882.
Martin Luther, born Nov. 10, 1483; died Feb. 18, 1546.
Benjamin Franklin, born Jan. 17, 1706; died April 17, 1790.
Shakespeare, born April 23, 1564; died April 23, 1616.
Napoleon I, born Aug. 15, 1769; died May 5, 1821.
Robert Burns, born Jan. 25, 1759; died July 21, 1796.
John Milton, born Dec. 9, 1608; died Nov. 8, 1674.

13. How long since the death of each of the above named persons?

14. 42 days from to-day comes on what day of the week?

Digitized by Google

1. How many degrees (°) in the circumference of a circle? (See page 14.) How many degrees in an arc which equals $\frac{1}{4}$ of the circumference?

2. Draw three circles of different size. Mark off arcs upon each of 90°; 45°; 180°; 60°; 40°. How do the arcs of the same number of degrees compare in length? A degree of the circumference of the earth at the equator is how long? Look at the globe, and tell how the circles or parallels of latitude compare in length. What can you say of the difference in the length of degrees of longitude?

3. $\frac{1}{60}$ of a degree is called a minute (′); $\frac{1}{60}$ of a minute is called a second (″). There are — seconds in a minute, — minutes in a degree, and — degrees in a circumference.

4. How many minutes in 6° 18′? in 12° 34′

5. How many seconds in 30′ 20″? in 42′ 38″?

6. How many seconds in 3° 48″? in 4° 24″?

7. How many degrees in 300′? in 1020′? in 450′?

8. What part of a degree is 18′? 36′? 16′ 30″? 48′ 20″?

9. What is the distance in degrees and minutes between two places, one 70° 18′, and the other 92° 30′ west longitude?

10. Find as near as you can on the map the longitude in degrees and minutes of New York; Baltimore; Chicago; San Francisco.

11. The longitude of Boston is 71° 3′ 30″ west from Greenwich, and that of Chicago is 87° 37′ west. How many degrees, etc., between the two cities? Reckoning the length of a degree as 52 miles, find the distance in miles.

12. On a map of the United States, measure by scale the distance from Philadelphia to Denver. Compare your answer with the answer obtained by reckoning the distance in degrees, allowing 53 miles to a degree.

13. A geographical mile is $\frac{1}{60}$ of a degree, and averages 6086.34 ft. How many geographical miles in the circumference of the earth at the equator? Reckoning the geographical mile to be equal to 1.15 common or statute miles, how many common miles in the circumference of the earth?

Digitized by Google

1. A nautical mile or knot is the same as a geographical mile. A vessel that sails 8 knots an hour goes how many miles a day? How long will it take her to sail 100 miles? 1000 miles?

2. At an average of 7 knots an hour, how many days, etc., will it take a steamship to sail from New York to Liverpool, a distance of 3540 miles?

3. A cubic foot of water weighs 1000 ounces. How many pounds and ounces of water in 5 cubic feet of water?

4. What is the weight of a cisternful of water, the cistern measuring 8 ft. long, 4 ft. 6 in. wide, and 3 ft. high?

5. A bushel measures 2150.42 cu. in. How many cubic inches in a peck? How many in a quart?

6. A box 4 ft. long, 3 ft. wide, and 2 ft. high will hold what quantity of beans?

7. How many bushels of wheat may be put into a bin that is 12 ft. 4 in. long, 6 ft. wide, and 4 ft. 2 in. high?

8. Allowing that heaped measures of potatoes, fruit, etc., fill one-fourth more than even measures, how many bushels of potatoes will the above bin hold?

9. How many bushels of apples, heaped measure, may be put into a bin that contains 152 cu. ft.?

10. How many quarts of berries, even measure, will a barrel hold that contains $2\frac{1}{2}$ cu. ft.?

11. A tourist in Germany paid 5.67 M. for first-class fare in riding 7 miles. If he had ridden second-class he would have paid 3.92 M., and third-class 2.17 M. (*a*) How much would he have saved by riding second-class? (*b*) How much by riding third-class? (*c*) Counting the German mile as 4.611 English miles, and the Mark as 23.8 cents, what was the difference in fares between first and second-class (United States money) in riding 1 English mile? (*d*) between second and third-class? (*e*) What was the difference in fares between first and second-class in riding 20 English miles? (*f*) At the same rates, what would be the difference of fares between second and third-class in riding from Berlin to Vienna, a distance of 380 English miles?

Digitized by Google

1. If 4 lb. of flour make 5 lb. of bread, how many pounds of bread will a barrel of flour (196 lb.) make? If one loaf weighs $1\frac{1}{2}$ lb., what is the cost of the flour necessary to make one loaf of bread, flour costing \$6 a barrel?

2. What is the freight on 4600 bushels of wheat at the rate of 40¢ per 100 lb.?

3. I buy oranges at 15¢ a dozen, and sell them at the rate of 3 for 5 cents. What is the profit on 1 dozen? on 100 oranges?

4. Bought pens at 40¢ a gross, and sold them at the rate of 2 for three cents. How much was made on a gross? How much on 300 pens?

5. A merchant buys 20 reams of paper at \$2.50 a ream, and sells 8 reams at the rate of 18¢ a quire. The rest he sells at 16¢ a quire. What was the profit?

6. A boy buys 4 quires of paper at the rate of 3 sheets for 2 cents, and sells it at the rate of 2 sheets for 3 cents. What did he gain?

7. What will 4 great gross of pencils cost at 15¢ a dozen?

8. Bought coal by the long ton at \$5.25, and sold it by the short ton at \$5.20 a ton. What was the gain or loss on 128 T. 600 lb.?

9. A poor widow paid 15¢ for a basket of coal weighing 25 lb. At the same rate, what would be paid for a ton?

10. A sheet of paper 20 × 24 inches, folded three times makes an octavo. How much will it cost for the paper of 1000 8vo books of 320 pp.? The paper is 36 lb. to the ream, and costs 8¢ a pound.

11. How many common bricks are there in a pile $8\frac{1}{2}$ ft. long, $8\frac{1}{4}$ ft. wide, $4\frac{3}{4}$ ft. high? How many less of Milwaukee bricks would there be in a pile of the same dimensions, each brick being $8\frac{1}{2} \times 4\frac{1}{8} \times 2\frac{3}{8}$ inches?

12. A race-course was marked out for $\frac{1}{2}$ mile with surveyor's chain 1 link too short. What was the true length of the track?

13. How many loads (cubic yards) of loam will it take to cover a lawn 40 ft. long, 20 ft. wide, the loam to be 3 in. deep.?

14. How many loads of gravel will be required for a road $\frac{3}{4}$ mi. long, if it is spread 10 ft. wide and 6 in. deep?

Digitized by Google

1. A barrel of flour weighs 196 lbs. How many tons and pounds do 50 barrels weigh?

2. How many barrels of flour in a cargo weighing 6 T. 1800 lb.? 18 T.? 8 T. 15 cwt.?

3. A barrel of beef or pork weighs 200 lb. How many tons, etc., do 175 bbl. of beef weigh?

4. How many tons and pounds in a cargo of 140 barrels of flour and 120 barrels of pork?

5. How many pounds of flour will it take to weigh as much as 58 bbl. of beef? How many barrels?

6. A merchant buys 8 bbl. of beef at $16.40 a barrel, and sells it at 10½¢ a pound. What was the gain?

7. A man buys 1000 bu. of wheat at 80¢ a bushel, and gets it ground into flour at 6¢ per cwt. What does the flour cost a barrel?

8. The city of Mexico is 99° 5′ west longitude, and Honolulu, Sandwich Islands, is 157° 55′ west. Allowing 65 miles to a degree, how many miles are the two cities apart?

9. The machinery hall at the Chicago Exposition was 494 ft. by 842 ft. How many acres of ground did it cover?

10. A boy walking at the rate of 3 miles an hour will go how far in 10 minutes? How long will it take him to walk 20 mi. 50 rd.?

11. A railroad train goes a distance of 30 miles in 50 minutes. What is the rate per hour? At the same rate, how many minutes will it take for the train to go 136 mi.? 8½ mi.?

12. From a barrel of kerosene containing 42 gal. there was sold at one time 18 gal. 3 qt. 1 pt., and at another time 12 gal. 2 qt. What is the remainder worth at 9¢ a gallon?

13. If 1 sack holds 4 bu. 1 pk. 3 qt. of wheat, how much does 128 sacks of the same size hold? How much is the wheat worth at 80¢ a bushel? Reckoning a bushel to weigh 60 lb., what will it cost at 90¢ per cwt.?

14. A cargo of corn weighing 16 tons is put into 280 bags, having an equal amount in each bag. How many pounds in each bag? Allowing 56 lb. to a bushel, how many bushels, etc., in each bag?

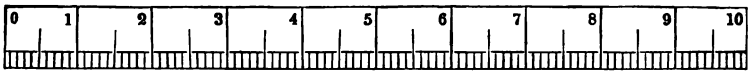
15. 1 cu. ft. of ice weighs 57 lb. 6 oz. Contents of a ton?

Digitized by Google

SECTION IV.

METRIC SYSTEM OF MEASURES AND WEIGHTS.

Measures of Length.



1 Decimeter = 10 Centimeters = 100 Millimeters.

1. The above measure is 1 decimeter in length. It is called *deci*meter because it is one tenth of a meter. With this as a guide, make out of string, paper, or wood a measure 1 meter long. Mark off lower denominations as follows: *deci*meters, *centi*meters (hundredths), and *milli*meters (thousandths). A distance ten times as great as a meter is called a *deka*meter; one hundred times as great, *hekto*meter; one thousand times as great, *kilo*meter. What part means tenths of? hundredths of? thoûsandths of? ten times? hundred times? thousand times?

2. Fill out blanks in the following table:

10 *millimeters* (^{mm})	= 1 *centimeter* (^{cm})	= — of a meter.
10 centimeters	= 1 decimeter (^{dm})	= — of a meter.
10 decimeters	= 1 *meter* (^{m})	
10 meters	= 1 dekameter (^{Dm})	= — meters.
10 dekameters	= 1 hektometer (^{Hm})	= — meters.
10 hektometers	= 1 *kilometer* (^{Km})	= — meters.
10 kilometers	= 1 myriameter (^{Mm})	= — meters.

The meter, centimeter, millimeter, and kilometer are the measures in most common use.

3. With a meter-stick or string find and express the length of your desk; diameter of a five-cent piece (nickel); length of your teacher's desk; length of your school-room; height of one of the doors; width of blackboard; height of school-room; width of the school-house lot.

Digitized by Google

1. Read: 6^{m}; 8^{dm}; 9^{cm}; 7^{Mm}; 4^{Dm}; 3^{Km}; 2^{mm}.

2. How many meters in 3^{Dm}? 1^{Hm}? 9^{Km}? 20^{dm}? 400^{dm}? 800^{cm}? 960^{cm}? 5000^{Mm}?

3. What part of a kilometer is 8^{Hm}? 4^{Dm}? 30^{m}? 650^{dm}?

4. How many millimeters in 8^{cm}? 50^{m}? $.4^{m}$? $.25^{cm}$?

5. Reduce to kilometers: 400^{m}; 380^{Hm}; 8000^{dm}; 6000^{mm}.

6. Write in denominations of meters each of the following: 6^{Dm}; 600^{dm}; 80^{Hm}; 9000^{mm}; 80^{cm}; $.7^{Km}$; $.08^{Hm}$.

7. In 8640^{m} how many kilometers? how many hektometers? how many dekameters?

8. Read 2846.593^{m}, giving the denomination of each figure, thus: 2^{Km} 8^{Hm}, etc.

9. Write 8^{Km} 5^{Hm} 7^{Dm} 7^{dm} and 4^{mm} on a decimal scale as meters.

10. Write 9^{Km} 3^{Dm} 4^{cm} 3^{mm} on a decimal scale as meters.

11. The circumference of a wheel which measures 3.2^{m} must revolve how many times to go 1^{Km}?

12. If the distance from A to B is 2^{Km} 3^{Dm}, and the distance from B to C is 250^{m}, how far, expressed in meters, is it from A to C *via* B?

13. From a piece of cloth containing 46.5^{m} there was sold 8.25^{m}. What is the remainder worth at 15 cents a meter?

14. The distance between two railroad stations is 6354^{Km}, and the distance between two telegraph poles is 90^{m}. How many telegraph poles will be needed for the entire distance?

Measures of Surface.

15. Draw on paper a square decimeter (^{qdm}). Divide the sides into 10 parts. How long is each side? Connect points of division forming squares. What is the size of each small square? Divide the sides of each small square into 10 parts, and connect as before. These very small squares are called what? Draw on the blackboard a square meter (^{qm}). Divide it into square decimeters.

A Square Centimeter.

Digitized by Google

1. Fill blanks in the following table :

100 square millimeters (^{qmm})	=1 square centimeter (^{qcm})	= — of a square meter.
100 *square centimeters*	=1 square decimeter (^{qdm})	= — of a square meter.
100 square decimeters	=1 *square meter* (^{qm}).	
100 square meters	=1 square dekameter (^{qDm})	= — square meters.
100 square dekameters	=1 square hektometer (^{qHm})	= — square meters.
100 square hektometers	=1 *square kilometer* (^{qKm})	= — square meters.

The square centimeter, square meter. and square kilometer are the measures most commonly used.

2. How many square centimeters in a square meter?

3. How many square meters in a square kilometer?

4. Read : 9^{qm}; 7^{qdm}; 10^{qKm}; 8^{qcm}; $.02^{qHm}$; 50^{qm}.

5. What part of a square kilometer is 1^{qDm}? 1^{qm}? 1000^{qm}?

6. Reduce to square meters : 10^{qDm}; $.01^{qHm}$; $.0001^{qKm}$.

7. In 9,603,976^{qm} how many square kilometers?

8. In 8,697,544^{qmm} how many square meters?

9. In 8,649,537^{qdm} read the number of square kilometers, square hektometers, square dekameters, and square meters.

10. In 6,905,783.693482^{qm} read the various denominations.

11. Reduce to square meters and add : 6^{qKm}; 84^{qHm}; 96^{qDm}; 200^{qdm}; 1000^{qcm}.

12. Reduce to square meters and add : 5^{qKm}; 50^{qDm}; 8000^{qcm}.

13. How many square meters in a floor 20.5^{m} long, 12.25^{m} wide?

14. How many square meters in a lot 50^{Dm} long and 400^{m} wide?

15. How many bricks, each 20^{cm} long, 10^{cm} wide, will it take to make a sidewalk 100^{m} long and 2.5^{m} wide?

A piece of land containing 1 square dekameter is called an *ar*. This is the chief unit for measuring land. A square meter of land is called a *centar*, and a square hektometer a *hektar*.

100 centars (^{ca})	=	1 ar (^{a})
100 ars	=	1 hektar (^{Ha})

16. Express in ars : 500^{ca}; 50^{ca}; 50,000^{ca}; 5^{ca}.

17. Express in ars : 2^{Ha}; $.04^{Ha}$; $.0008^{Ha}$; 60^{Ha}.

Digitized by Google

1. What will 85^{a} of land cost at \$5.50 per ar?

2. What will 100^{a} of land cost at \$500 per hektar?

3. Bought 8^{Ha} of land at \$300 per hektar, and sold it at \$3.40 per ar. What was the gain or loss?

4. If I divide a lot of land containing 16^{Ha} into 80 equal lots, how many square meters will there be in each lot? How many ars?

Measures of Volume.

5. The chief unit of volume is the *cubic meter* ($^{cu\ m}$). From what you know of cubic measure, estimate how many cubic decimeters there are in $1^{cu\ m}$. In the same way find the number of cubic centimeters in 1 cubic decimeter, and how many cubic millimeters in 1 cubic centimeter. Fill blanks in the following table:

— cubic millimeters ($^{cu\ mm}$) = 1 cubic centimeter ($^{cu\ cm}$).
— cubic centimeters = 2 cubic decimeter ($^{cu\ dm}$).
— cubic decimeters = 1 cubic meter ($^{cu\ m}$).

6. Express in decimals of a cubic meter $1^{cu\ dm}$; $1^{cu\ cm}$; $1^{cu\ mm}$.

7. $1^{cu\ dm}$ is how many times as large as $1^{cu\ cm}$?

8. $1^{cu\ m}$ is how many times as large as $1^{cu\ cm}$?

9. Reduce $8^{cu\ m}$ $48^{cu\ dm}$ to cubic centimeters.

10. Reduce $8{,}500{,}000^{cu\ mm}$ to cubic meters.

11. How many cubic meters of earth were removed in digging a cellar 12^{m} long, 8.5^{m} wide, and 3.5^{m} deep? How many loads, if each load contained $2.5^{cu\ m}$?

12. In a school-room 9.5^{m} long, 6.4^{m} wide, and 3.2^{m} high there are 42 pupils. How many cubic meters of air are there to each pupil?

13. In measuring wood, the cubic meter is called a *ster* (st). How many sters in a pile of wood containing $120{,}000^{cu\ dm}$?

14. How many sters of wood in a pile 18^{m} long, 1.3^{m} wide, and 2.5^{m} high?

15. A pile of wood 45.5^{m} long, 1.5^{m} wide, and 1.8^{m} high is worth what, at \$2.40 a ster?

Digitized by Google

Measures of Capacity.

1. The chief unit of measure in measuring liquid, grain, etc., is the *liter* (^{l}). It contains 1 cubic decimeter. Draw on slate or paper a vessel in the form of a cube which would contain 1 liter. How long is the vessel in centimeters? How many cubic centimeters in a liter?

2. The prefixes *deci, centi,* etc., have the same value in measures of capacity as they have in measures of length. What does deciliter (^{dl}) mean? dekaliter (^{Dl})? centiliter (^{cl})? hektoliter (^{Hl})? kiloliter (^{Kl})? milliliter (^{ml})? Construct the table of capacity beginning with

10 milliliters (^{ml}) = 1 centiliter (^{cl}).

3 Reduce to liters: 8^{Hl}; 600^{dl}; 80^{cl}; 4000^{ml}; 90^{Dl}.

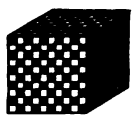
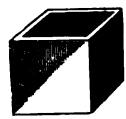
4. Reduce to kiloliters: 8000^{l}; $78{,}000^{cl}$; 400^{Dl}.

5. Reduce to deciliters: 45^{l}; $.008^{Dl}$; $.05^{Hl}$; 4^{Kl}.

6 A box measuring 20^{cucm} contains how many liters?

7. How many liters of water will a tank contain that is 3^{m} long, 2^{m} wide, and 1^{m} deep? How many hektoliters?

Measures of Weight.

1 Cubic Centimeter is the contents of 1 Milliliter, which weighs 1 Gram.

8. The unit of weight is the *gram* (^{g}), which is the weight of a cubic centimeter of water having a temperature of 39° Fahrenheit. A gram of water measures how much?

The prefixes *deci, centi,* etc., used in measures of length, are used with gram to designate measures of weight.

9 What is the weight in grams of 1 decigram (^{dg})? 1 centigram (^{cg})? 1 dekagram (^{Dg})? 1 hektogram (^{Hg})? 1 milligram (^{mg})? 1 kilogram (^{Kg})? Construct the table of weight.

Digitized by Google

1. Reduce to grams: 40^{Dg}; 80^{Hg}; 9^{Kg}; 800^{dg}; 6000^{cg}.

2. Add and express in grams: 8^{Hg}; 3^{Dg}; 4^{g}; 9^{dg}; 7^{cg}; 1^{mg}.

3. Write the following as one number in the denomination of grams: $6^{Hg}\ 9^{g}\ 8^{dg}\ 1^{mg}$.

4. Read the following in different denominations: 437.842^{g}; 906.074^{g}; 700.406^{g}.

5. Reduce to grams: $86{,}970^{mg}$; $.0840^{Kg}$.

6. What is the weight of $86^{cu\ cm}$ of water?

7. How many grams does $1^{cu\ dm}$ of water weigh?

8. How many kilograms does 1 liter of water weigh?

9. Find the weight of a tank of water that contains 120^{Hl}.

10. Find the weight of the water in a cistern 4^{m} long, 3^{m} wide, and 2^{m} deep.

Equivalents in United States Measures.

1^{m}	$=$ 39.37 in., or about 1 yd. $3\frac{3}{8}$ in.
1^{Km}	$=$ .62137 mi., or about $\frac{5}{8}$ of a mile.
$1^{q\,m}$	$=$ 1.196 sq. yd., or about $10\frac{3}{4}$ sq. ft.
1^{a}	$=$ 119.6 sq. yd., or about 4 sq. rd.
1^{Ha}	$=$ 2.471 A., or about $2\frac{1}{2}$ A.
$1^{cu\,m}$	$=$ 1.308 cu. yd., or about $35\frac{1}{3}$ cu. ft.
1^{st}	$=$ .2759 cd., or about 2 cd. ft.
1^{l}	$=$ 1.056 liquid quart, or about 1 qt. $\frac{1}{2}$ gi.
1^{Hl}	$=$ 2.837 bu., or about 2 bu. $3\frac{1}{3}$ pk.
1^{g}	$=$ 15.432 gr., or about $14\frac{1}{2}$ gr.
1^{Kg}	$=$ 2.2046 lb., or about $2\frac{1}{5}$ lb. (avoirdupois).
1 metric ton	$=$ 2204.6 lb., or about 1 T. 200 lb.

First get approximate values, and then exact values, in United States measures of the following measures:

11. 50^{m}; 300^{m}; 5^{Kg}; 60^{Kg}; $40^{q\,m}$; 8^{a}; 100^{a}; 6^{Ha}; $8^{q\,Km}$; $6^{cu\,m}$.

12. $120^{cu\,m}$; 4^{st}; 50^{st}; 6^{l}; 40^{l}; 8^{Hl}; 40^{g}; 8^{Kg}; 20^{T}; 16^{Km}; 42^{st}.

13. 80^{cm}; 6400^{cm}; 5460^{a}; 8.45 metric tons; 40^{st}; 86.4^{l}.

14. 8^{st}; 240^{st}; 6.4^{Ha}; $84.5^{q\,m}$; 4680^{Kg}; 8648^{g}; 3808^{a}.

Digitized by Google

Miscellaneous Review Exercises.

1. Name two places that you think are 1 hektometer apart. Test by pacing, first measuring the pace. Name the villages or towns that are about 10 kilometers apart.

2. At the rate of 3^{Km} an hour, how long will it take a boy to walk 8000^{m}?

3. At \$2.50 a meter, what is the cost of 80^{m} of cloth? 8.60^{m}?

4. If I cut a piece of cloth 80.50^{m} long into 6 pieces, how many centimeters long is each piece?

5. It is 70^{Km} between two cities. If a man starts from one of them, and walks the first day $18{,}000^{m}$, the second day $21{,}640^{m}$, the third day $16{,}480^{m}$, how many kilometers are left for him to walk the fourth day?

6. Show by drawing the relation between the measures of length, capacity, and weight: 1 cubic decimeter contains 1 —— and weighs 1 ——.

7. How many kilograms or kilos of water in a reservoir 80.60^{m} long, 30.40^{m} wide, and 15^{m} deep?

8. How many hektoliters of water will a cistern contain which is 8.80^{m} long, 6^{m} wide, and 4.40^{m} deep?

9. How many liters of grain can be put into a bin 6^{m} long, 4^{m} wide, and 3^{m} deep?

10. How many sters of wood in a pile 8.60^{m} long, 1.50^{m} wide, and 2^{m} high?

11. How wide must a lot of land 160^{m} long be to contain 8^{a}?

12. How many square kilometers in a piece of land 560^{m} long, 80.40^{m} wide? What is it worth at \$80 per ar?

13. If a piece of land containing 8.60^{Ha} be divided into 12 lots, how many square meters in each lot? At 6¢ a liter, what is paid for 8^{Hl} of milk?

14. From a lot of land 2^{Km} long and 200^{m} wide there were sold two house-lots, each containing 3 ars. How many square meters are left?

15. How many meters of fence will it take to inclose a piece of land 4^{Hm} long and 5^{Dm} wide?

Digitized by Google

1. What will $18^{m}\ 6^{dm}$ of cloth cost at \$1 a yard?

2. A bin 4.5^{m} long, 2^{m} wide, and 3^{m} deep will hold how many liters of grain?

3. How many cubic meters of space in a box 2.5^{m} long, 1.8^{m} wide, and 8^{dm} deep (inside measure)? How many liters of grain will the box contain?

4. How many cubic meters of earth will fill a hole 6.4^{m} long, 3.8^{m} wide, and 2.1^{m} deep? How many loads, if each load contains $1.6^{cu\ m}$?

5. How long will it take to walk 40^{Km} at the rate of 4000^{m} an hour?

6. Ten dollars in 5-cent pieces weighs how much, if each piece weighs 5^{g}?

7. In a field 20 rd. long, 140 ft. wide, how many square meters? How many ars?

8. How many sters in a pile of wood 18 ft. long, 4 ft. wide, and 4 ft. high?

9. How many meters long must a pile of wood be to contain 18^{st}, if it is 2.5^{m} high and 1.5^{m} wide?

10. How many metric tons and kilograms in 4 T. 6 cwt.?

11. What is the weight in kilograms of 1000 silver half-dollars, each coin weighing $12\frac{1}{2}$ grams?

12. How many silver half-dollars will it take to weigh as much as a barrel of flour?

13. What is the weight of a bar of iron 4.60^{m} long, 7^{cm} wide, and 1.80^{cm} thick, specific gravity being 7.8?

14. From a farm containing 90^{Ha} there was sold $42^{Ha}\ 8^{a}$. What is the remainder worth at \$150 a hektar?

15. A field of 18 acres was divided into 24 house-lots. How many hektars and ars in each lot?

16. Find the approximate number of miles in a straight line between Chicago and Boston, and estimate the distance in meters.

17. From the number of square miles in your city or town find the number of square meters. Find the number of hektars.

18. How many ars in the lot on which your school-house stands?

Digitized by Google

SECTION V.

PERCENTAGE AND APPLICATIONS.

Oral Exercises.

	1.	2.	3.	4.
a.	$\frac{1}{2}$ of 6	$\frac{1}{10}$ of 20	.05 of 400	.10 of 20
b.	$\frac{1}{4}$ of 12	$\frac{8}{10}$ of 30	.12 of 600	.16$\frac{2}{3}$ of 12
c.	$\frac{3}{4}$ of 12	$\frac{7}{10}$ of 50	.20 of 300	.33$\frac{1}{3}$ of 18
d.	$\frac{4}{5}$ of 20	$\frac{9}{10}$ of 60	.50 of 200	.12$\frac{1}{2}$ of 80
e.	$\frac{3}{10}$ of 40	.1 of 40	.75 of 400	.08$\frac{1}{3}$ of 120
f.	$\frac{7}{12}$ of 36	.9 of 30	.25 of 100	.87$\frac{1}{2}$ of 40
g.	$\frac{8}{20}$ of 60	$\frac{1}{100}$ of 200	.33$\frac{1}{3}$ of 600	.75 of 160
h.	$\frac{6}{25}$ of 100	$\frac{3}{100}$ of 400	.37$\frac{1}{2}$ of 600	.66$\frac{2}{3}$ of 27
i.	$\frac{9}{30}$ of 90	$\frac{12}{100}$ of 600	.62$\frac{1}{2}$ of 700	.16$\frac{2}{3}$ of 48
j.	$\frac{3}{50}$ of 20	$\frac{20}{100}$ of 800	.66$\frac{2}{3}$ of 300	.62$\frac{1}{2}$ of 300

Find :

5. .25 of 12; of 20; of 100; of 160; of 480; of 60.4.
6. .75 of 16; of 40; of 60; of 240; of 600; of 84.8.
7. .37$\frac{1}{2}$ of 24; of 32; of 120; of 400; of 720; of 80.8.
8. .40 of 25; of 50; of 35; of 75; of 125; of 20.5.
9. .33$\frac{1}{3}$ of 36; of 48; of 75; of 120; of 360; of 63.6.
10. .62$\frac{1}{2}$ of 32; of 40; of 72; of 160; of 400; of 48.8.
11. .87$\frac{1}{2}$ of 80; of 96; of 120; of 240; of 720; of 96.4.
12. 1.10 of 40; of 90; of 140; of 180; of 300; of 50.8.
13. 1.25 of 80; of 72; of 120; of 240; of 800; of 60.4.
14. 1.33$\frac{1}{3}$ of 60; of 90; of 144; of 360; of 420; of 84.6.
15. 1.37$\frac{1}{2}$ of 20; of 32; of 160; of 400; of 24.8; of 40.16.
16. 1.66$\frac{2}{3}$ of 24; of 60; of 240; of 18.6; of 3.12; of 60.3.
17. 2.80 of 6; of 45; of 8.4; of 20.5; of 640; of 12.24.
18. 1.08$\frac{1}{3}$ of 6; of 48; of 120; of 60.12; of 8; of 480.24; of 1.5.

Digitized by Google

Another name for hundredths is *per cent*, and the sign for per cent is % or p. c.

Express the following in three ways, — as a common fraction, as a decimal, and with the sign of per cent :

	1.	2.	3.	4.
a.	1 per cent	12 per cent	1 per cent	43 per cent
b.	7 "	$12\frac{1}{2}$ "	$\frac{1}{2}$ "	126 "
c.	12 "	$37\frac{1}{2}$ "	$37\frac{1}{2}$ "	101 "
d.	20 "	$62\frac{1}{2}$ "	$83\frac{1}{3}$ "	$\frac{2}{3}$ "
e.	25 "	$87\frac{1}{2}$ "	$\frac{1}{3}$ "	55 "
f.	50 "	$12\frac{1}{2}$ "	$\frac{1}{4}$ "	200 "
g.	75 "	$8\frac{1}{3}$ "	$\frac{3}{4}$ "	$14\frac{2}{7}$ "
h.	100 "	$16\frac{2}{3}$ "	$\frac{1}{5}$ "	85 "
i.	125 "	$33\frac{1}{3}$ "	$\frac{2}{5}$ "	30 "
j.	250 "	$66\frac{2}{3}$ "	$\frac{5}{6}$ "	$\frac{7}{8}$ "

What per cent of a number is

5. $\frac{1}{100}$ of it? $\frac{2}{100}$? $\frac{5}{100}$? $\frac{10}{100}$? $\frac{12\frac{1}{2}}{100}$? $\frac{25}{100}$? $\frac{50}{100}$? $\frac{75}{100}$? $\frac{90}{100}$? $\frac{100}{100}$?

6. $\frac{1}{2}$ of it? $\frac{1}{3}$? $\frac{2}{3}$? $\frac{1}{4}$? $\frac{3}{4}$? $\frac{1}{5}$? $\frac{2}{5}$? $\frac{3}{5}$? $\frac{1}{6}$? $\frac{5}{6}$?

7. $\frac{1}{7}$ of it? $\frac{1}{8}$? $\frac{3}{8}$? $\frac{5}{8}$? $\frac{7}{8}$? $\frac{3}{10}$? $\frac{1}{12}$? $\frac{1}{20}$? $\frac{1}{50}$? the number itself? $2\frac{1}{2}$ times the number?

8. $\frac{2}{3}$ of it? $\frac{5}{6}$? $\frac{3}{8}$? $\frac{1}{12}$? $\frac{7}{8}$? $\frac{5}{12}$? $\frac{1}{25}$? $\frac{13}{12}$? $\frac{15}{12}$? $\frac{5}{8}$?

Express as common fractions in lowest terms :

	9.	10.	11.	12.	13.
a.	1%	140%	$87\frac{1}{2}$%	$8\frac{1}{3}$%	5%
b.	5%	200%	$83\frac{1}{3}$%	$12\frac{1}{2}$%	10%
c.	8%	20%	50%	$16\frac{2}{3}$%	20%
d.	10%	$12\frac{1}{2}$%	$\frac{1}{2}$%	$33\frac{1}{3}$%	25%
e.	15%	$8\frac{1}{3}$%	$\frac{3}{4}$%	$37\frac{1}{2}$%	50%
f.	25%	$16\frac{2}{3}$%	$\frac{1}{6}$%	$62\frac{1}{2}$%	75%
g.	50%	$33\frac{1}{3}$%	$\frac{1}{4}$%	$66\frac{2}{3}$%	$37\frac{1}{2}$%
h.	75%	$37\frac{1}{2}$%	$\frac{2}{3}$%	$83\frac{1}{3}$%	$33\frac{1}{3}$%
i.	100%	$62\frac{1}{2}$%	$\frac{7}{8}$%	$87\frac{1}{2}$%	$12\frac{1}{2}$%
j.	125%	$66\frac{2}{3}$%	$\frac{3}{5}$%	75%	$87\frac{1}{2}$%

Digitized by Google

	1. What is 1% of	2. What is 10% of	3. What is 25% of	4. What is 75% of	5. What is $12\frac{1}{2}$% of
a.	100 ?	\$40 ?	\$400 ?	\$16 ?	24 qt. ?
b.	300 ?	\$200 ?	160 da. ?	72 sheep ?	\$500 ?
c.	150 ?	\$150 ?	240 wk. ?	80 ?	\$0.72 ?
d.	840 ?	\$360 ?	56 bu. ?	\$240.80 ?	\$7.60 ?
e.	780 ?	\$1935 ?	5.6 lb. ?	\$25 ?	140 mi. ?
f.	75 ?	\$13,046 ?	14.4 T. ?	\$500 ?	600 rd. ?
g.	80.50 ?	\$8 ?	.4 A. ?	\$320 ?	320.08 A. ?
h.	101.65 ?	\$76 ?	.25 bbl. ?	\$$\frac{1}{2}$?	48$\frac{1}{2}$?
i.	1.63 ?	\$150.50 ?	1000 ft. ?	\$8$\frac{1}{2}$?	4.86 yd. ?
j.	.50 ?	.65 ?	\$1.25 ?	\$16$\frac{2}{3}$?	

6. Find 20% of each number given in Exercise 1.

7. Find 50% of each number given in Exercise 4.

8. Find 30% of each number given in Exercise 2.

9. What is 60% of each of the following numbers: 20, 50, 40, 35, 90, 65, 85, 125 ?

10. What is 4% of 60 ? 6% ? 8% ? $12\frac{1}{2}$% ? $16\frac{2}{3}$% ? 10% ? $33\frac{1}{3}$% ? $83\frac{1}{3}$% ? 25% ? 75% ?

11. What is $62\frac{1}{2}$% of 96 ? $33\frac{1}{3}$% ? 1% ? $\frac{1}{2}$% ? $87\frac{1}{2}$% ?

12. What is 125% of 12 ? 50% ? $83\frac{1}{3}$% ? $66\frac{2}{3}$% ? 200% ?

13. Find $33\frac{1}{3}$% of 24; of 72; of 108; of 480; of 7.20.

14. Find $83\frac{1}{3}$% of \$.810; of 365 bu.; of \$$\frac{1}{4}$; of 54 oranges.

15. Find $8\frac{1}{3}$% of \$.480; of \$1.08; of 720 yd.; of .024 yd.; of 60.72 da.; of $\frac{1}{2}$ mi.; of \$9600; of 96 A.; of \$480.72.

16. What is $87\frac{1}{2}$% of 160 bu. ? of \$8.40 ? of 24.8 ft. ? of 600 A. ?

17. A man having a salary of \$1600 a year, spent $62\frac{1}{2}$% of it for living expenses, $12\frac{1}{2}$% of it for clothing, $6\frac{1}{4}$% of it for travel and amusement. What sum was given for each, and what sum remained ?

18. A merchant buys flour at \$5 a barrel, and sells it so as to gain 20%. What did he gain on one barrel ? What did he sell the flour for a barrel ?

Digitized by Google

Oral and Written Exercises.

What is:

1.	16% of 4.35?	of $16.95\frac{3}{8}$?	of 469.47?
2.	35% of 846?	of $1278\frac{8}{8}$?	of .09436?
3.	92% of 1004?	of 49?	of $48\frac{5}{12}$?
4.	103% of $34.78?	of $16.90\frac{3}{4}$?	of $2476\frac{1}{8}$?
5.	113% of 39.72\frac{1}{2}$?	of 1003.84?	of 784.1 mi.?
6.	205% of 976.04?	of $75.25?	of 69.50?
7.	57% of .00693?	of $\frac{8}{8}$?	of 83.625 A.?
8.	8.5% of 117?	of 6.94?	of 346?
9.	$9\frac{1}{2}$% of $\frac{1}{3}$?	of $4\frac{3}{8}$?	of 7.2104?
10.	$\frac{1}{3}$% of 841?	of $\frac{5}{6}$?	of .04109?

11. What is 10% of 200 mi.? 100%? 200%? 110%? 125%? $166\frac{2}{3}$%? 225%?

12. Find 100% + 25% of $80; of 105; of 225; of 375; of 500.

13. Find 100% + $62\frac{1}{2}$% of 24; of 36; of 108; of 90; of 600.

What is:

14.	100% of 12?	of 30?	of $25?	of 40 mi.?
15.	100% − 50% of 12?	of 30?	of $25?	of 40 mi.?
16.	100% − 25% of 12?	of 16?	of 96?	of 40 mi.?
17.	100% − $33\frac{1}{3}$% of 12?	of 108?	of 36?	of 48 mi.?
18.	100% − 10% of 80?	of 240?	of 300?	of 25 mi.?

Find:

19.	.4% of 463	of 8.845	of $\frac{5}{7}$
20.	$8\frac{2}{3}$% of $748.02	of 15.01	of $\frac{8}{9}$
21.	$\frac{1}{2}$% of 4693	of 79.2485	of $12\frac{5}{8}$
22.	$\frac{3}{4}$% of 8.482	of $\frac{5}{16}$	of 4751
23.	65% of 34,821	of 3047.2	of $85.95\frac{3}{4}$
24.	1.1% of $15.66	of $1477.75	of $\frac{4}{9}$
25.	$\frac{7}{8}$% of $\frac{1}{4}\frac{8}{5}$	of 24,900	of .38209
26.	3.4% of 61,827 h.	of $\frac{9}{25}$	of 463.892
27.	$4\frac{2}{3}$% of 935.83 yd.	of 869,131	of $5\frac{3}{10}$
28.	8% of $\frac{2}{3}$	of .0004	of 245,375

Digitized by Google

1. Last year Mr. Howard's salary was $3000. If he saved $8\frac{1}{3}\%$ of it, how much money did he save?

2. My house and lot cost me $4800, and the house cost $37\frac{1}{2}\%$ of the whole. What was the cost of the house?

3. If in a school of 216 pupils $66\frac{2}{3}\%$ are boys, how many boys are there in the school?

4. The average daily attendance in the above school is $87\frac{1}{2}\%$ of the whole number. What is the average daily attendance?

5. A grocer had a barrel containing 40 gallons of oil, and 5% of it leaked out. How much oil did he lose?

6. In an orchard of 492 trees $33\frac{1}{3}\%$ are peach and $16\frac{2}{3}\%$ are pear trees. How many peach trees in the orchard? How many pear?

7. 25% of a regiment of 800 men were wounded. How many men were wounded?

8. In a high school of 240 pupils 5% of the pupils study Greek, 10% Latin, 15% French, and 75% algebra. How many pupils pursue each of these studies?

9. A farmer having 400 sheep loses 20% of them and sells 25% of the remainder. How many does he sell?

10. I sold $12\frac{1}{2}\%$ of a flock of 320 sheep at $5 a head. What did I receive for them?

11. How many persons are engaged in agriculture when they constitute $62\frac{1}{2}\%$ of a population of 72,320?

12. How much does a grocer make by selling at 20% profit flour that cost $5.75?

13. If 80% of a certain ore is copper, how much copper is there in 3400 pounds of ore?

14. I bought a farm for $3550, and sold it at a gain of $33\frac{1}{3}\%$. What was the gain? For what did I sell it?

15. In 1880 the population of a certain city was 80,450. In 1890 it had increased 20%. What was the population in 1890?

16. Bought 200 bushels of wheat for $160, and sold it at a gain of 20% on the cost. What did I sell it for a bushel?

17. If you have $1850 dollars in the bank, and draw out 28% of it, how much remains in the bank?

Digitized by Google

Written Exercises.

1. A schooner formerly valued at $7500 has depreciated 15%. What is its present value?

2. What is $\frac{1}{7}$% of $56.49? $\frac{3}{5}$% of $40.56?

3. A man having a yearly income of $3200 saves 12½% of it one year, 15% of it the second year, and 18% of it the third year. How much does he save in the three years?

4. Jordan, Marsh & Co. bought goods of English firms to the amount of $5200, and of American firms to the amount of $4928. The English goods were sold at a gain of 62½%, and the American at 37½% gain. What profit did they make?

5. Wheat, from the time it is threshed, shrinks 6%. How much will 6800 bu. of wheat weigh after shrinking? How many bushels will there be in 3 tons after shrinking, allowing 60 lb. to a bushel?

6. Corn shrinks 20% from the time it is first husked. How many bushels will 6800 lb. of corn measure after shrinking, allowing 56 lb. to a bushel?

7. A grocer, on receiving 250 boxes of oranges, found 16% spoiled. What would he receive for the remaining boxes at $3 a box?

8. A lawyer charged 7½% for collecting a bill of $320, and 8¾% for collecting $695. How much did he receive for his services?

9. A Minneapolis flour merchant bought at one time 8420 bbl. of flour. He sold 20% of it to a Boston merchant, 10% of the remainder to a firm in New York, and 50% of what still remained to a Portland firm. How many barrels were left unsold?

10. 45% of an army of 85,000 men are cavalrymen. How many men are cavalrymen?

11. I bought a horse for $175, and sold it at a loss of 12.5%. What was my loss?

12. What is 4.245% of $8460?

13. Out of 3 casks, one containing 112, the second 95, and the third 125 gal. of molasses, 8% was lost by leakage, and 45% was sold. How many gallons remained, and what was its value at 8¢ a quart?

Digitized by Google

1. What is 55% of 12 cwt. 3 qr. 15 lb. ?

2. A farmer raised 5972 bu. of grain, and sold 65% of it at 65¢ per bushel. How much did he receive for it ?

3. If a certain cloth shrinks $4\frac{1}{8}$% of its length, what is the shrinkage of a piece containing 38 yd. before shrinkage?

4. I lend $5000 for 6 months at the rate of $4\frac{1}{2}$% a year. What interest do I receive ?

5. Goods which cost $8500 were sold at a gain of $21\frac{1}{2}$%. How much profit was made ?

6. A merchant having some shop-worn articles that cost him $130, has marked them down 10%. What is his reduced price ?

7. The estimated value of United States exports and imports during a certain year was $15,000,000, and 14% of it was carried in our own ships. What was the value of goods carried by them ?

8. In 1876 the amount entered at the British ports was 25,067,264 tons. If $3\frac{1}{4}$% of this was supplied by the United States, how many tons were supplied ?

9. In 1890, 36,835,712 tons of shipping were entered at the British ports, and $\frac{2}{5}$% of it was supplied by the United States. How many tons less were supplied in 1890 than in 1876 ?

10. Chicago's population in 1880 was 503,185. During the following ten years it had gained $118\frac{3}{4}$%. What was the population in 1890 ?

11. In 1880 the population of New York was 1,206,299. If it had gained 25.6% during the following ten years, what was its population in 1890 ?

12. A farmer raised 1860 bu. of potatoes. He sold 40% of them at 75¢ a bushel. For what still remained he got 80¢ a bushel. What did he get for the entire crop ?

13. If $5\frac{5}{8}$% of tin plate consists of pure tin, how many pounds of pure tin will be required to make a box of tin plate weighing 108 pounds ?

14. A man whose wages are $1.50 per day, spent 8% of his earnings in beer and tobacco. How much does he spend a year for beer and tobacco ?

Digitized by Google

Oral Exercises.

	1. What part of	2. What part of	3. What part of
a.	4 is 2?	40 is 32?	100 is 5?
b.	12 is 6?	80 is 24?	100 is 20?
c.	16 is 4?	108 is 96?	100 is 25?
d.	20 is 5?	140 is 49?	100 is 50?
e.	25 is 5?	75 is 27?	100 is 75?
f.	12 is 2?	96 is 84?	300 is 200?
g.	35 is 7?	100 is 1?	100 is 100?
h.	35 is 14?	100 is 2?	100 is $1\frac{1}{2}$?
i.	15 is 5?	100 is 3?	100 is 300?
j.	20 is 2?	100 is 4?	700 is 70?

4. 50 is what part of 75? of 40? of 20? of 80? of 1500? of 5?

5. What per cent of a number is the whole of it? $\frac{1}{2}$ of it? $\frac{1}{3}$ of it? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$? $\frac{1}{8}$? $\frac{1}{12}$? $\frac{1}{20}$? $\frac{1}{25}$?

6. What per cent of a number is $\frac{2}{3}$ of it? $\frac{3}{4}$ of it? $\frac{3}{5}$ of it? $\frac{3}{8}$? $\frac{4}{5}$? $\frac{5}{8}$? $\frac{5}{6}$? $\frac{7}{8}$? $\frac{1}{50}$? $\frac{1}{100}$?

7. Find the per cents in Exercise 1.

8. Find the per cents in Exercise 2.

9. Find the per cents in Exercise 3.

	10. What per cent of	11. What per cent of
a.	18 is 9?	25 miles is 1 mile?
b.	45 is 9?	300 dollars is 12 dollars?
c.	144 is 24?	250 feet is 50 feet?
d.	51 is 17?	120 barrels is 40 barrels?
e.	120 is 15?	32 gallons is 4 gallons?
f.	480 is 320?	450 dollars is 90 dollars?
g.	108 is 90?	750 dollars is 75 dollars?
h.	96 is 16?	3 days is 12 hours?
i.	240 is 20?	3600 minutes is 900 minutes?
j.	810 is 90?	800 dollars is 500 dollars?

Digitized by Google

1. A boy had 40 marbles, and gave away 15 of them. What part of his marbles did he give away? What per cent of his marbles did he give away? What per cent of them did he keep?

2. If from every bushel he grinds, a miller takes out 4 quarts, what part of the grain does he take? What per cent of it?

3. If of a box of oranges $\frac{1}{4}$ is sold, and of the remainder $\frac{1}{8}$ is unsalable, what per cent of the oranges is not salable?

4. A fruit-grower transplanted 250 peach trees, and 40 died. What per cent of them died?

5. 900 acres of a Florida plantation of 1200 acres are marsh. What per cent of the plantation is marsh?

6. A stock-dealer sold 80 cows from a herd of 400 cattle. What was the per cent of cattle sold?

7. A merchant shipped 2500 bushels of grain from Chicago, and 600 bushels were thrown overboard in a storm. What was the per cent of loss?

8. In an orchard of 200 trees all but 60 bore fruit. What per cent of the trees was not fruitful? What per cent was fruitful?

9. A watch which cost \$60 was sold for \$45. How many dollars were lost? What per cent of the cost was lost?

10. I lost $16\frac{2}{3}\%$ of my money. What per cent of it had I left?

11. I invested \$480 and lost \$80. What was the per cent of loss?

12. Of 144 yd. of ribbon 108 yd. have been sold. What per cent of the ribbon has been sold? What per cent of it remains?

13. Owning a house worth \$7000, a man charges \$500 for rent. What per cent a year does he receive for it?

14. What per cent of the letters of the following sentence are vowels? — *Arithmetic is a knowledge of numbers.*

15. A man having \$7500 gave \$3500 to one son and the remainder to the other. What per cent of his money did he give each?

16. If of a school of 45 pupils, 25 are boys, what per cent of the whole number are girls? If 2 boys and 3 girls should leave school, what per cent of the whole number would be boys?

17. If 6 oranges of a box consisting of 5 dozen are not good, what per cent of the whole number are good?

Digitized by Google

Written Exercises.

A.	*B.*	*C.*	*D.*	*E.*	*F.*
1200	150	$\frac{2}{3}$	.45	$37\frac{1}{3}$	487
840	75	$8\frac{7}{8}$	.05	$9\frac{3}{7}$	19.28
50.6	100	$5\frac{3}{5}$	2.6	$18\frac{1}{2}$	134.6
150.25	250	$18\frac{1}{2}$	.125	$30\frac{9}{10}$	45.06
156	40	$5\frac{1}{4}$	18.25	$15\frac{7}{8}$	7.108

1. What per cent of *A* is *B*?
2. *D* is what per cent of *C*?
3. What per cent of *E* is *D*?
4. *F* is what per cent of *A*?
5. *E* is what per cent of *B*?
6. What per cent of *E* is *C*?
7. What per cent of *F* is *B*?

	8. What per cent of	9. What per cent of
a.	9875 is $1234\frac{3}{8}$?	1600 bushels is 96 bushels?
b.	63000 is 7350?	\$1250 is \$375?
c.	6250 is $2062\frac{1}{2}$?	\$1040 is \$7.80?
d.	6319 is $789\frac{7}{8}$?	1 cwt. 2 qr. 4 lb. is 7 lb. 11.2 oz.?
e.	44 is 3.3?	4h. 25 min. 12 sec. is 2 h. 12 min. 36 sec.?
f.	125 is 110?	63 gallons is 10.08 gallons?
g.	2250 is 281.25?	\$2000 is \$8?
h.	.625 is $\frac{1}{8}$?	\$2607 is \$393?
i.	4000 is 20?	$\frac{2}{3}$ is $\frac{1}{10}$?
j.	5600 is 798?	4200 sheep is 600 sheep?

10. Find the per cent that 56 is of 840; of 210; of 28; of 7; of 420; of 365; of 724; of 490; of 367.25; of 824.3.

11. What per cent of 70 is 35? of 100; of 125? of 4.35? of $37\frac{1}{2}$? of 35? of 90? of 320? of 700? of 490?

12. If goods costing \$7500 sell at a gain of \$2725, what per cent is gained?

13. The population of North America in 1890, in round numbers, was 90,000,000. In Canada it was 4,829,411, and in the United States 62,831,827. What per cent of the whole population had each country?

Digitized by Google

1. The area of the United States is 3,501,410 sq. mi. What per cent of that area does each of the following States cover: Massachusetts, 8040 sq. mi.; New York, 47,620 sq. mi.; California, 155,980 sq. mi.; and Texas, 262,290 sq. mi.?

2. It is estimated that in Asia there are 850,000,000 people. Of this number 50,000,000 are Mohammedans, 175,000,000 are Brahmins, and 340,000,000 are Buddhists. What is the per cent of each sect?

3. Great Britain and Ireland had in 1890, 20,000 miles of railroad, while the United States had 150,000. What per cent more of railroad had the United States than Great Britain and Ireland?

4. In 1880 the population of the United States was 50,250,000. Of this number 6,580,000 were colored persons and 380,000 Indians. What per cent of the population was colored? What per cent Indians? What per cent whites?

5. The British Empire contained (1891) 300,000,000 people. 37,888,153 of these live in the United Kingdom. What per cent does not live in the United Kingdom?

6. The area of the British Empire is 8,350,000 sq. mi., and of this the United Kingdom includes 121,481 sq. mi. What per cent of the whole area does the United Kingdom include?

7. An agent received $126 for collecting a debt of $2520. What was his rate of commission?

8. My New Orleans agent charged me $75.50 for purchasing 27,500 lb. sugar at $3.25 per 100 lb. Find the rate of his commission.

9. Sugar which cost $4.37½ a hundredweight is sold at the rate of 20 lb. for a dollar. What is the per cent of gain?

10. If 300 pounds of charcoal are required to make a ton of gunpowder, what per cent of gunpowder is charcoal?

11. I bought a barrel of molasses, consisting of 36 gal., for $16.60, and sold it for 55¢ a gallon. What was the per cent of profit?

12. If I pay a broker $15 for selling a piece of land for $1200, what per cent commission do I pay him?

Digitized by Google

Oral and Written Exercises.

1. What is 20% of 600 trees? of $75? of 175 acres? of 625 bu.? of 750 gal.? of 945 miles? of $1025? of 895 bbl.?

2. What per cent of	3. What per cent of	4. Of 1 bushel find
90 is 30?	1 bu. is 1 pk.?	50%
240 is 16?	1 pk. is 1 bu.?	$33\frac{1}{3}$%
$620 is $310?	2 lb. is 4 oz.?	$62\frac{1}{2}$%
$4.80 is $2.40?	6.4 yd. is 1.28 yd.?	$87\frac{1}{2}$%
$4.00 is $0.50?	$3\frac{1}{2}$ A. is 2 A.	$66\frac{2}{3}$%
.5 is 25?	4 quarts is $1\frac{1}{2}$ gal.?	1.75%

5. If $100 gains $5 interest in one year, what per cent is gained? If it gains $8, what per cent? $10? $4½? $3.50? $18.25?

6. What is the interest of $100 for 1 year at 6% a year? at 4%? at 10%? at 2½%? at 12¼%?

7. If money is worth 6% a year, what per cent of a given sum will be earned in 6 mo.? in 3 mo.? in 9 mo.? in 1 yr. 6 mo.? in 2 yr. 3 mo.?

8. What is the interest of $200 for 1 yr. at 4%? for 2 yr.? for 4½ yr.? for 6 mo.? for 3 mo.?

9. If I pay $5 for the use of $100 for a year, what per cent interest do I pay?

10. If $200 put at interest 6 months gains $8, what per cent a year does the money gain?

11. What is the interest of $800 for 3 months at 7% a year?

12. What is the interest of $1200 for 2 months at 4½% a year?

13. $100 put on interest 1 yr. 6 mo. gains $8. What per cent a year is gained?

14. What is the interest of $780 for 1 yr. 3 mo. at 5%?

15. If $300 is put on interest at the rate of 4%, what will it amount to at the end of 6 months?

16. If the amount as found in the last example is put on interest at the same rate, what will it amount to at the end of another 3 months?

Digitized by Google

1. A man's interest money amounts to $50 a month. If his principal is $12,500, what rate of interest does his money gain?

2. What is the interest of $1500 for 2 yr. 3 mo. at 4%?

3. $200 put into the savings bank January 1, 1894, will amount to what July 1, 1894, the rate of interest being 4% a year? What will it amount to January 1, 1895, if nothing is drawn out?

4. What rate of interest is charged if $20 is asked for a loan of $2000 for 3 months?

5. A broker buys a farm for me for $2000, charging me 1% for his trouble. What is his commission, and what does the farm cost?

6. John has 8 cents, James has 10 cents. John's money is what per cent of what both have? John's money is what per cent of James's? James's money is what per cent of John's?

7. A real estate agent gets $80 for selling a house for $6000. What per cent commission does he charge?

8. What remains of an income of $800 after 10% is spent? after 40% is spent? $62\frac{1}{2}\%$? $87\frac{1}{2}\%$? $66\frac{2}{3}\%$?

9. From a cask containing 90 gal. of oil, 4 gal. 2 qt. leaked out. What per cent leaked out?

10. A man having $6000, invested 25% of it in bank stock, and put 50% of the remainder in the savings bank. What sum remained uninvested?

11. If wages are advanced from $1.50 to $1.75 a day, what is the per cent of increase?

12. Potatoes which cost 80¢ a bushel should be sold for what sum to gain 25%? to gain 15%? to lose 10%? to lose 40%? to gain 30%?

13. An agent charged $13.50 for collecting a debt of $3375. What was his rate of commission?

14. An agent sells a house for me at $2600, and charges $\frac{3}{4}\%$ commission. What is his fee?

15. If I receive in dividends $400 a year upon stocks which cost me $9200, what per cent do I receive upon my investment?

16. Mr. Brown's house is valued at $4800. It is insured for three-fourths of its value at $\frac{1}{2}\%$. What is the cost of insurance?

Digitized by Google

1. Paid $16.50 for insuring a house worth $4200. What was the rate?

2. If to 28 gallons of alcohol 12 gallons of water are added, what per cent of the mixture is alcohol? What per cent is water?

3. What would a dishonest merchant gain per cent by using a weight of 15 ounces instead of a pound?

4. A fruit dealer buys oranges at 15¢ a dozen, and sells them at the rate of 2 for three cents. What is his gain or loss per cent?

5. What per cent of 4 square feet is 4 feet square?

6. A bushel of potatoes was bought for 60 cents, and sold for 16 cents a peck. What was the per cent of profit?

7. What per cent of 60 is $\frac{1}{2}\%$ of 6000.

8. A merchant gains 20% on the sale of 40% of his goods, and he loses 5% on the balance. What is his net gain per cent?

9. The taxes on real estate in a town are at the rate of $2\frac{1}{4}\%$ of valuation. What tax must be paid on a farm valued at $2300?

10. If the cost of a thing is $\frac{3}{4}$ of what it is sold for, what per cent is gained?

11. A merchant sells coal at the same price per ton (2000 lb.) as he pays for it per long ton. What is his per cent of profit?

12. I sell stock at 90 which cost me 112. What per cent do I lose?

13. The public debt of the United States in the year 1866 was $2,773,236,173.69; in 1876 it was $2,180,395,067.15; in 1886 it was $1,783,438,697.78; and in 1890 it was $1,546,961,695.61. Give per cent of decrease in each interval.

14. A man failed in business owing $6842. His assets were $2560. What per cent did he pay his creditors?

15. In an examination, 20 questions were given in each subject, and a candidate answered correctly 14 questions in arithmetic, 16 in geography, 17 in English grammar, and $12\frac{1}{2}$ in history. Find the average per cent passed in these subjects.

16. When gold was worth 40% more than currency, what was the value in gold of a dollar bill?

17. What per cent of $1800 is $\frac{1}{8}\%$ of $9000?

Digitized by Google

Oral Exercises.

1. 4 is $\frac{1}{2}$ of what number? $\frac{1}{3}$? $\frac{1}{6}$? $\frac{1}{8}$? $\frac{1}{10}$? $\frac{2}{3}$? $\frac{2}{5}$? $\frac{1}{12}$? $\frac{1}{20}$? $\frac{1}{50}$?

2. 24 is $\frac{2}{3}$ of what number? $\frac{2}{4}$? $\frac{4}{5}$? $\frac{8}{9}$? $\frac{6}{11}$? $\frac{4}{20}$? $\frac{6}{40}$? $\frac{1}{50}$? $\frac{3}{50}$? $\frac{6}{50}$?

3. 4 is $\frac{1}{40}$ of what number? $\frac{1}{50}$? $\frac{1}{100}$? $\frac{2}{100}$? $\frac{3}{100}$? $\frac{6}{100}$? $\frac{12}{100}$? $\frac{24}{100}$? $\frac{25}{100}$? $\frac{75}{100}$? $\frac{50}{100}$?

4. 12 is $\frac{50}{100}$ of what number? $\frac{20}{100}$? $\frac{25}{100}$? $\frac{80}{100}$? $\frac{12}{100}$?

5. 5 is 50% of what number? 25%? 20%? 30%? 40%? 50%? 60%? 70%? 10%? 12%? 15%?

6. 6 is 50% of what number? 12½%? 10%? 4%? 20%? 33⅓%? 37½%? 40%? 60%? 75%? 90%? 16⅔%?

7. 9 is 10% of what number? 8⅓%? 5%? 1%? 50%? 100%? 133⅓%? 62½%? 83⅓%? 87½?

8. 16 is 1% of what number? ½%? ¼%? 5%? 8%? ⅛%? ⅔%? ¾%? ⅞%? ⅛%? 16%? 100%? 200%?

Find the number of which:

9.	10.	11.	12.
40 is 20%	\$6 is 6%	8 is 100%	30 horses is 25%
180 is 66⅔%	\$42 is 7%	12 is 125%	105 mi. is 33⅓%
24 is 37½%	\$25 is 10%	10 is ½%	96 oz. is 12%
270 is 62½%	£750 is 50%	15 is 120%	1240 mi. is 5%

13.	14.
40% of — = 32	6% of — = \$48
16⅔% of — = 90	1% of — = 37½ sq. ft.
83⅓% of — = 330	½% of — = 40 mi.
75% of — = 1200	¾% of — = \$15

15. 45 is 20% of what number? 15? 35? 65? 70? 105? 270? 250? 300? 150? 175? 500? 1000? 4000?

16. 12 is ⅓ more than what number? 10 is ¼ more than what number? 13 is $\frac{3}{10}$ more than what number?

17. 30 is 25% more than what number? 50%? 20%? 10%? 5%? 16⅔? 33⅓? 75%? 87½%?

Digitized by Google

1. What number increased by 10% of itself is 66? 77? 110? 121? 80? 120? 30? 45? 230? 160?

2.

25 = 5% of what?
60 = 8% of what?
65 = 108⅓% of what?
231 = 7% of what?

3.

96 sq. in. = 166⅔% of what?
140 sq. rd. = 87½% of what?
160 sq. rd. = 25% of what?
160 cu. ft. = 125% of what?

4. A number diminished by 10% is 45. What is the number? by 20%? 50%? 75%? 12½%?

5. 24 is 33⅓% less than what number? 20%? 37½%? 40%? 25%? 62½%? 50%? 83⅓? 87½? 66⅔?

6. A number increased by 16⅔% is 42. What is the number? by 50%? 66⅔%? 83⅓%? 100%? 200%? 150%? 300%?

7. 80 yd. is 12½% of how many yards? 5%? 10%? 20%? 25%? 37½%? 40%? 50%? 62½%?

8. $40 is 25% more than how many dollars? 33⅓%? 66⅔%? 75%? 80%? 20%?

9. 8 is ⅛ less than what? ⅔ less than what? ⅕ less than what?

10. 60 gallons is 25% less than how many gallons? 50%? 75%? 33⅓%? 5%? 2%? 83⅓%?

11. I have $35, which is 5% of what my brother has. How much has my brother?

12. A farmer gained 10% for selling his horse for $25 more than it cost him? What was the cost?

13. Mr. White's yearly income of $2000 is 5% of the sum he invested. How much has he invested?

14. A business block is rented for $1500, which is 33⅓% of its value. What is the value of the block?

15. A lawyer received $70, which was 3% of the sum collected. How much did he collect?

16. Owning 80% of a ship, I sold 25% of my share for $19,800. What is the entire value of the ship?

17. $350 was paid for a carriage, which was 16⅔% more than the price of the horse. What was paid for the horse?

Digitized by Google

Written Exercises.

1.	2.
37 is 12% of what?	£3400 is 8% of what?
75.45 is 3½% of what?	2000 tons is 115% of what?
$324.65 is 5% of what?	2000 tons is 83% of what?
$476 is ⅛% of what?	219 days is 60% of what?
$960.50 is 8% of what?	873.25 is 4½% of what?

3. $9820 is 85% of what? 20% more than what? 30% less than what? 12½% more than what?

Find the number of which

4. 8 is 9%.	**9.** 345 is 100%.	**14.** 438.70 is 16%.
5. 30 is 14%.	**10.** 70 is 66⅔%.	**15.** 84 is .3%.
6. 42 is 10%.	**11.** 36 is ⅓%.	**16.** 630 is 250%.
7. 37 is 4½%.	**12.** 7½ is 6¼%.	**17.** ⅝ is 95%.
8. 28.4 is 7%.	**13.** ⅝ is ¾%	**18.** 16⅔ is 16⅔%.

19. 96.8 is 3% more than what number?

20. $2400 is 4⅔% less than what number?

21. A man sold his house for 16% above cost, and made $400. How much did the property cost?

22. A coasting vessel has on board 245 baskets of peaches, averaging 3 pecks to the basket, which is 15% of the cargo. How many bushels are there in the cargo? If sold for $1.75 per basket, what is the value of the cargo?

23. A man paid me $225, which was 33½% less than the amount owed me. What is still owed me?

24. Sold goods at a gain of 22%. The profit was $47.80. For how much were they sold?

25. The assets of a business man are $175,420, or 112½% of his debt. Find his indebtedness.

26. 40% of a number exceeds 8% of it by 170. What is the number?

27. A merchant sold 350 bbl. of flour at 30% profit, and gained $424.04. What was the cost per barrel?

Digitized by Google

Oral and Written Exercises.

1. Express as common fractions in lowest terms: $33\frac{1}{3}\%$; 50%; $62\frac{1}{2}\%$; $83\frac{1}{3}\%$; $12\frac{1}{2}\%$; 75%; $16\frac{2}{3}\%$; $8\frac{1}{3}\%$; 40%; 90%; $37\frac{1}{2}\%$; 25%; 80%; $66\frac{2}{3}\%$.

2. What is 25% of \$80? 5%? 10%? 50%? $16\frac{2}{3}\%$? 8%? 80%? 6%? $87\frac{1}{2}\%$? 100%? 1%? $\frac{1}{2}\%$? $37\frac{1}{2}\%$? $33\frac{1}{3}$? 125%? 200%?

3. What per cent of 120 is 60? 40? 45? 80? 96? 36? 100? 12? 8? 90? 120? 10? 30? 25? 75? 240? 24? 105? 6?

4. 18 is 2% of what number? 6%? 8%? 10%? 32%? $33\frac{1}{3}\%$? $83\frac{1}{3}\%$? 25%? 100%? 50%? 75%? 150%? 200%? $66\frac{2}{3}\%$? 100%? 91%? $12\frac{1}{2}\%$?

Find:

5.	6.	7.
4% of 75	6% of \$100	75% of 280 men
10% of 125	40% of \$180	60% of 20 rd.
$16\frac{2}{3}\%$ of 720	3% of \$200	$66\frac{2}{3}\%$ of 165 gal.
8% of 108	25% of £2000	$87\frac{1}{2}\%$ of \$480

8. What number increased by 25% of itself is 230?

9. What is the number of which 25 is 10%? 50%? 20%? $12\frac{1}{2}\%$? 80%? $37\frac{1}{2}\%$?

What per cent of

10.	11.	12.
36 is 9?	\$300 is \$18?	65 bu. is 39 bu.?
72 is 27?	360 sheep is 60 sheep?	420*s.* is 70*s.*?
340 is 17?	120 rd. is 40 rd.?	90 qt. is 30 qt.?

13. To 25 add 5% of it.
14. To 640 A. add $12\frac{1}{2}\%$ of it.
15. From 3 score take $62\frac{1}{2}\%$.
16. To 144 sq. in. add $33\frac{1}{3}\%$.
17. From \$100 take $4\frac{1}{2}\%$.
18. From 128 cd. take 25%.

19. What number diminished by 75% of itself equals \$630? \$8? \$140? \$602? \$88? \$72? \$240? \$320?

Digitized by Google

1. Find $37\frac{1}{2}\% + 12\frac{1}{2}\% + 33\frac{1}{3}\% + 18\frac{3}{4}\% + 12\frac{1}{2}\% + 6\frac{1}{4}\%$ of 292.

2. Increase a number by $8\frac{1}{3}\%$ of itself and it equals 43. What is the number?

3. 45% of 680 = ?
4. $\frac{1}{8}\%$ of 423 = ?
5. 236 oz. = 35% of what?
6. 1¢ is what % of \$1?
7. 7% of $7\frac{1}{2}$ = what?
8. 74 pk. is what % of 74 pk.?
9. 45 is what % of 25?
10. $4\frac{1}{2}\%$ of .37 = ?
11. 49 is 1% of what?
12. 25 is 100% of what?
13. 6% of \$37.45 = what?
14. 40 is what % of 940?
15. 6000 men = 82% of what?
16. 112% of 3.3 = ?
17. 728 = 100% − 6% of what?
18. 560.24 = what % of 1008?
19. 2800 = what % of 3200?
20. 85% of 3695 = ?
21. 860 = 16% of what?
22. 1242 = $8\frac{1}{3}\%$ of what?
23. 3.3 = .3% of what?
24. 175% of 4778 bu. = ?
25. $\frac{5}{6}\%$ of $\frac{2}{3}$ = ?
26. £500 5*s.* is what % of £670?

27. By selling goods at 25% above cost which is \$12, how much is gained? How much if the cost is \$16? \$20? \$1.60?

28. How much is lost by selling goods that cost \$15 at 20% below cost? How much if the goods cost \$10? \$70? \$100?

29. Bought a piece of silk for \$40, and sold it at 75% profit. What was gained? For what was it sold?

30. At what price must oranges that cost 18¢ a dozen be sold to gain $66\frac{2}{3}\%$? to gain 50%? 25%? $37\frac{1}{2}\%$? 40%? 5%? To lose $16\frac{2}{3}\%$? 50%? 25%? $83\frac{1}{3}\%$?

31. A dealer bought coal for \$875, and sold it at a gain of 27%. What was his gain, and for what was the coal sold?

32. In 1875 I invested \$10,000 in house-lots in a town in Missouri. In five years the value had increased $82\frac{1}{2}\%$. What was the gain, and how much were the lots worth in 1880?

33. A grocer bought a hogshead of sugar containing 1800 lb. at $3\frac{3}{4}$¢ per pound. He sold it so as to gain $33\frac{1}{3}\%$. What was his gain per pound, and what was his entire gain? How many pounds did he give for \$1?

Digitized by Google

1. Paid $3420.80 for a cargo of flour, and lost 23%. What was received for the flour?

2. Bought 180 bbl. of flour, and sold it at a gain of 12½%. For what was it sold per barrel if it all cost $864?

3. What per cent is gained if goods costing 20¢ a yard are sold for 30¢? 25¢? 40¢? 35¢? 18¢? 50¢?

4. If goods costing 75¢ a yard are sold for 50¢, what per cent is lost? What if they are sold for 70¢? 65¢? 35¢? 30¢?

5. If a horse is bought for $150, and sold at a gain of $75, what per cent is gained? What if sold at a gain of $175?

6. A grocer sold tea for 60¢ a pound, which cost him 42¢. What per cent did he gain?

7. A. T. Stewart & Co. bought from a French firm 650 yd. of cloth for $1462.50. At what price per yard must they sell it to gain 33⅓%? If it is sold for $3.15 per yard, what is the gain per cent?

8. Bought 2 horses for $250 each, and sold one at a gain of $37.50, the other at a loss of $37.50. Required the rate per cent of gain and loss, and selling prices.

9. The population of a certain city has increased in 5 years by 4000. If the whole population was 60,420, what is the rate of increase?

10. Carpetings were bought at 75¢, 95¢, $1.25, and $1.45 per yard. 25¢, 30¢, 50¢, 70¢ per yard respectively were gained. Find the per cent of gain for each lot.

11. What is the cost of ribbon when a gain of 20¢ a yard in selling is 5% of the cost? 10%? 25%? 40%? 50%? 75%? 100%?

12. What per cent is gained if goods costing 40¢ a pound are sold for 42¢? What if sold for 45¢? 50¢? 60¢? 65¢? 70¢?

13. What was the cost of lace marked 87½¢ a yard, if the marked price is 33% more than the cost?

14. By selling coal at $6 a ton, 20% was gained. What was the cost per ton? What per cent gain if sold for $5.50?

15. A merchant bought 114 barrels of apples, and sold them at $3 a barrel, gaining 14%. What did the apples cost?

Digitized by Google

1. Owning $\frac{2}{3}$ of a mill, I sold $\frac{1}{4}$ of my share for $2500, which was $12\frac{1}{2}\%$ more than its estimated value. Find estimated value of my share; of the whole mill.

2. Sold coffee for 35¢ a pound, and lost 5%. How much did I pay for the coffee?

3. What did I pay for a house that was sold for $5425, at a gain of 8%?

4. If of a carload of fruit valued at $500, 20% is spoiled, and I sell the remainder at an advance of $12\frac{1}{2}\%$ on its cost, do I gain or lose, and how much?

5. Having some books damaged by fire, I sold them at $62\frac{1}{2}\%$ below cost. I received $245. What was their cost?

6. A wholesale grocer sold 5 hogsheads of molasses, each containing 62 gallons of molasses, at 10¢ a quart, losing 4%. What did the whole cost him?

7. When cloth is bought at $1.25 a yard, and sold for 95¢, what is the per cent of loss?

8. Bought a cow for $40, which was $12\frac{1}{2}\%$ less than her real value. What was her real value?

9. Paid for making a dress $9, which was $13\frac{1}{3}\%$ more than the cost of material. What was the cost of material?

10. Mr. Brown bought butter at 20¢ a pound. At what price must he sell it to gain 25%? 10%? $12\frac{1}{2}\%$? $16\frac{2}{3}\%$? 5%? To lose 5%? 4%? $12\frac{1}{2}\%$? 20%? 25%?

11. Chickens were sold for $24, and 25% was gained. For how much should they have been sold to gain $33\frac{1}{3}\%$?

12. What per cent would be gained by selling a plough that cost $10 for $12?

13. What was the loss per cent of selling milk for $4\frac{1}{2}$¢ a quart, that cost 5¢?

14. What is the cost of milk which sells for $4\frac{1}{2}$¢ at a loss of $11\frac{1}{9}\%$?

15. A bushel of wheat was sold for $1.75. What was paid for it if 20% was gained? 5%? 60%?

16. How much is lost on a farm which sells for $4000 at a loss of 30%?

Digitized by Google

Educ T 118.94.700.

T5
7361

HARVARD

LIBRARY

Department

COLLECTION
Contributed

TRAN

Digitized by Google

Digitized by Google

1. 45 kegs of nails were bought, each containing 90 lb., at $5\frac{1}{4}¢$ a pound, and they were sold for what $\frac{7}{10}$ of them cost. What was the per cent of loss?

2. Taylor, Dismore & Co. bought 650 yd. of velvet for $1950. For how much per yard must it be sold to gain $33\frac{1}{3}\%$?

3. I lost 20% of my property by the Mississippi floods, and 28% of it by fire. How much had I originally, if $6970 worth of property remained?

4. By selling flour at $5 a barrel I shall lose 10% of the cost. How much must I sell it for to gain 10%?

5. For how much must I sell 230 cd. of wood which cost $3.75 per cord to gain $12\frac{1}{2}\%$?

6. A house worth $12,000 is insured for $\frac{2}{3}$ of its value at 2% a year. What is paid yearly for insurance?

7. What is the premium on $2000 worth of goods at $\frac{1}{2}\%$?

8. Mr. Thompson paid $250 for the insurance of silverware in his store. If the face of the policy was $10,000, what was the rate of insurance?

9. A premium of $70 is 5% on what valuation? 1%? 2%? $\frac{1}{2}\%$? $\frac{3}{4}\%$?

10. A house valued at $12,540, and furniture valued at $6470, are both insured for $\frac{3}{4}$ of their value at $\frac{5}{8}\%$. What is the annual premium?

11. $8.25 was paid for insuring a barn at $\frac{3}{8}\%$. What was the property valued at?

12. A house was insured at $4\frac{1}{4}\%$ for $\frac{3}{5}$ of its value. The insurance company received $171.50, including $1.50 for policy. What was the value of the house?

13. A new block in Chicago is insured in four companies: a London company, taking $\frac{1}{4}$ the risk at $1\frac{1}{2}\%$; a Honolulu company, taking $\frac{1}{8}$ at $\frac{1}{2}\%$; a Boston company, taking $\frac{1}{8}$ at $\frac{3}{4}\%$; a New York company, taking the remainder at $\frac{7}{8}\%$. What premium is paid for the insurance, if the value of the block is $240,000? How much of the loss would each company have to pay if the block is damaged by fire to the amount of $10,000?

Digitized by Google

1. A man took an endowment policy of $30,000 for 25 years at 5% a year. Which will be greater, the sum paid or the sum insured?

2. The New York Mutual Insurance Company insured my factory at $1\frac{3}{4}\%$. The premium paid was $224.50. For what was the factory insured?

3. If your life is insured for $8000 at $\$14.37\frac{1}{2}$ per thousand, what premium will you have to pay annually?

4. A cotton factory worth $4000, and the machinery worth $15,000, are insured for $62\frac{1}{2}\%$ of their value. If the company insuring charges 3%, what is paid for the insurance?

5. A commission merchant bought 60 bbl. of flour at $4.50 a barrel, and received for his trouble a commission of 3% of what he paid. What was his commission?

6. If as agent I sell a cargo of cotton for $1480, and charge $2\frac{1}{2}\%$ commission, what is my commission, and what sum do I send my employer or principal?

7. A lawyer collects a certain sum of money for me, and charges $\frac{1}{4}$ of what he collects for his trouble, sending me the balance, or $30. What does he collect? He charges what per cent for collection?

8. I sent to a commission merchant $408, which was intended to cover the cost of goods that he bought and his commission of 2% of the cost. What was the cost of the goods?

9. I receive $1020 with which to buy goods for a merchant in Utica. If the sum that I receive includes what I pay out and my commission of 2% on what I pay out, what is my commission?

10. A broker bought for me some railroad stock, for which he paid $1960. His commission for buying was $\frac{1}{2}\%$. What did the stock cost me?

11. A broker buys 50 shares of railroad stock at 78% of the par value. If the par value of each share is $100, what does he pay for the stock? His commission for buying is $\frac{3}{4}\%$ of the cost of stock. What is his commission?

12. A meter-stick is how much longer than a yard-stick? What per cent longer?

Digitized by Google

Digitized by Google

Brown
630 lb.
at the
eceipt-

'89

CO.

REET.

Stuart 1640 lb.
. Rule and make

t payment for the
on the bill.

Digitized by Google

1. A fruit-dealer bought oranges at 25¢ a dozen, and sold them at the rate of 3 for 10¢. What was the gain per cent?

2. If 10% of the weight of beets is sugar, how many pounds of sugar in 18 bu. of beets, allowing 60 lb. to the bushel? How many pounds of sugar can be extracted from these beets if 60% of the sugar is obtained?

3. What is the tax-rate in a town where $14,500 is raised on property valued at $2,500,000?

4. I pay $15 for a saddle, which is 6¼% of what I pay for a horse. What is the cost of the horse?

5. If 15% of lead-ore is lead, how many pounds of ore will it take to yield 600 lb. of lead?

6. The area of your State is what per cent of the area of the United States?

7. A pound Troy is what per cent of the weight of a pound Avoirdupois?

8. A certain kind of wood when burned yields 2½% of its weight in ashes. How many pounds of wood will it take to yield 50 lb. of ashes? How many pounds of ashes can be made by burning a load of wood weighing 1500 lb.?

9. If pine wood is 40.9% as heavy as oak wood, how much will a load of oak wood weigh which measures the same as a load of pine wood weighing 1800 lb.?

10. Bituminous coal is 1¼ times as heavy as water, and anthracite coal is 1½ times as heavy as water. What per cent of the weight of anthracite coal is bituminous coal?

11. 80 bushels of oats, each weighing 32 lb., is what per cent as heavy as 20 barrels of flour?

12. What is the interest of $840 for 1 yr. 8 mo. at 4%?

13. I paid $6 for the use of $50 for 2 years. What rate of interest did I pay per year?

14. I drew out of the savings bank interest money amounting to $16.80, which was 2½% of what was left on deposit. What was left on deposit? If this money draws interest at the rate of 3½% a year, how much interest money shall I have in 6 months?

Digitized by Google

SECTION VI.

BUSINESS TRANSACTIONS.

1. As clerk for C. F. Bradley & Co., you sell Albert G. Brown 2 ft. pine kindling, the price of which is $11.50 a cord; 2030 lb. egg coal, the price of which is $6.50 a ton. Copy and fill out the following bill of sale, making the sale to occur to-day, and receipting for the firm :

West Dover, ... *189*

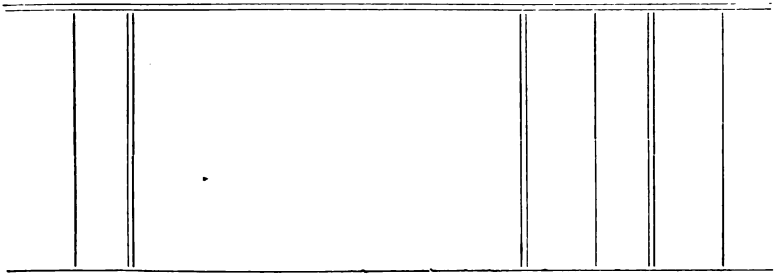
M .....

Bought of **C. F. BRADLEY & CO.**

DEALERS IN

Coal, Wood, Hay, and Grain,

5000 WASHINGTON STREET.



2. As clerk for the same firm, you sell Wm. P. Stuart 1640 lb. hay at $22 a ton, and 12 bu. corn at 65¢ a bushel. Rule and make in proper form a bill of sale.

3. Suppose Mr. Stuart gives you $10 as part payment for the goods sold him. Make the proper statement on the bill.

Digitized by Google

1. As clerk for C. F. Bradley & Co., you receive from a customer $123.50, payment in full for all that he owes the firm. He asks for a receipt. Copy and fill out the following:

$\$$ ..... 189.....

Received from .....

..... 100 Dollars,

for .....

.....

2. Copy the following bill, and explain each item:

Peoria, Sept. 20, 1893.

Alonzo P. Grigson.

To SAMPSON, BROWN & CO., *Dr.*

1893.						
June	1	*To 4 bbl. Beef*	@	$22.50,		
July	7	" *680 lb. Butter*	@	28¢,		
"	"	" *450* " *Pork*	@	6¢,		
					$	
		Cr.				
July	1	*By Cash*		$40.00		
Sept.	1	" *18 bbl. Apples @ $4.50*				
				$		
		Balance due,			$	

3. Suppose your account as a merchant with Samuel Ring is as follows: He owes you for $3\frac{1}{2}$ yd. of cloth at 75¢ a yard, bought Jan. 8; 13 yd. of carpet at 45¢ a yard, bought Feb. 9, and a piece of cotton cloth for $4.20, bought Apr. 16. Mar. 1 he paid you $10, and comes May 1 desiring to settle. Make out bill in proper form.

Digitized by Google

1. You buy of Asa L. Hewett a horse and carriage for $350, paying him $200 down, and giving him a note for the balance, due in 6 months, bearing interest at 5%. Write in proper form the receipt which he would give you. Make out the note which you give him, filling the following blank:

$..... .....*189*

.....*after date*.....*promise to pay to the order of*.....

.....*Dollars,*

with interest at.....*per cent. Value received.*

.....

2. When must you pay this note? How much must you pay?

3. You sell Wm. P. Brown a cow for $60, due in 6 months, with interest at 6%. He gives you his note for this amount. Write the note in proper form. When and how much will he pay you? Suppose he were to pay you the $60 at any time you demanded it, without interest, how would the note be written?

4. In Book No. 5, page 76, there is given a simple form of keeping a cash account. According to that form, write an account such as John Jones would make, containing the following items:

On Monday morning, John Jones has in cash $14.60. On Tuesday he spends for provisions $3.25, and receives $1.50 for letting horse half a day. On Wednesday he receives $2.50 for repairing Samuel Brown's carriage, and pays out 25¢ for express and $1.70 for cloth. On Thursday he spends $3.50 for a pair of shoes. On Friday he receives $3.75 from John Smith for use of horse and carriage, and pays out $4.36 for grain. On that day also he receives $4.50 from A. Robinson for 2 days' labor. On Saturday he pays a bill of $5.16 for meat, and receives $1.25 for labor.

Rule the paper properly, give date of present week, balance the account, and begin the account for next week.

Digitized by Google

1. Rule paper and copy carefully the following account that you have with Edgar L. Reed. Fill out balance, and total sums of debt and credit.

		EDGAR L. REED.	Dr.		Cr.	
1894.						
Jan.	*4*	*By labor, 2 days,*			*$3*	*00*
"	"	*To 2 bu. Potatoes @ 80¢,*	*$1*	*60*		
"	*5*	*" 3½ qt. Milk @ 6¢,*		*21*		
"	*6*	*" Apples,*	*1*	*00*		
"	*13*	*By labor, 5½ days,*			*8*	*25*
"	"	*To Cash,*	*5*	*00*		
"	*16*	*" Grain,*	*1*	*15*		
"	*17*	*" ½ pk. Onions,*		*18*		
"	*20*	*By labor, 5 days,*			*7*	*50*
"	"	*To Cash,*	*5*	*00*		
"	*24*	*" 2½ lb. Butter @ 28¢,*		*70*		
"	*25*	*" 4½ lb. Chicken @ 22¢,*		*99*		
"	*27*	*By labor, 6 days,*			*9*	*00*
"	"	*To Cash,*	*6*	*60*		
"	*31*	*" 22 qt. Milk @ 6¢,*	*1*	*32*		
"	"	*Balance,*				
1894.						
Feb.	*1*	*Balance,*				

2. What does the first item mean? Did he work for you, or did you work for him? What does "Dr." mean? What does "Cr." mean? Suppose Mr. Reed had come to you January 10, desiring to settle, how would the account have stood? Explain each item. How does the account stand at the end of the month?

Digitized by Google

1. Write the account (page 74) on opposite pages of a book, thus:

EDGAR L. REED.		Dr.		EDGAR L. REED.		Cr.	
1894.				*1894.*			
Jan. 4	*To 2 bu. Potatoes at 80¢*	*$1*	*60*	*Jan. 4*	*By labor, 2 days,*	*$3*	*00*

Rule paper in either of the two forms preceding, and make proper entries of the following accounts:

2. Account with James Robinson. June 1 he owes you $2.85. June 5 you sell him 2 qt. berries @ 12¢, ½ pk. peas 30¢, and 2½ lb. steak @ 28¢. June 8 he and two of his men work for you 6 hours, each 25¢ an hour. June 9 you sell him 2½ lb. chops @ 28¢, ½ pk. potatoes 20¢. June 12 he and one man work for you 3½ hours, each at 25¢ an hour. June 15 you sell him 7 lb. lamb @ 22¢, and berries 28¢. June 21 you sell him 1¾ lb. steak @ 28¢, and he pays you on account $3. June 24 you sell him 3 pk. potatoes @ 30¢, cucumbers 12¢, olives 35¢, and 2¼ lb. steak @ 28¢. June 28 you sell him 6½ lb. beef at 24¢, and berries for 30¢. How does the account stand at the end of the month?

3. Account with Charles J. Holmes. July 1 you owe him $6.24. July 3 you buy of him 2 doz. lemons @ 25¢, ½ lb. coffee 19¢, and 10 lb. sugar @ 6¢. July 5 you buy of him 5 gal. oil @ 10¢, gelatine 15¢, 2 lb. rice @ 9¢. July 6 you sell him 6 bu. potatoes @ 68¢. July 8 you buy 1 lb. tea 60¢, ex. lemon 40¢, wicks 5¢. July 10 you buy 10 lb. sugar @ 6¢, cocoa 24¢, and biscuit 30¢. July 15 you buy ½ lb. coffee 19¢, and flour $1.40, and you pay him on account $5. July 19 you buy 1½ doz. lemons @ 25¢, 2 lb. wheat germ @ 13¢, biscuit 20¢, 2 lb. brown sugar @ 7¢, and sell him 18½ lb. butter @ 28¢. July 24 you buy 5 gal. oil @ 10¢, walnuts 20¢, and 3 lb. oatmeal @ 6¢. How does the account stand July 31?

4. As a farmer or country merchant, give imaginary transactions involving the making out of bills, receipts, and notes, and the keeping of accounts with certain people.

Digitized by Google

1. Oct. 24, 1893, you sell Thomas Lanman a horse and carriage for $275. He pays $100 cash, and gives his note for the balance, payable on demand, with interest at 6%. Write the note such as he should sign. Suppose you call for the payment of the note Jan. 24, 1894. How much is due you at that time? Make out a receipted bill of sale.

2. Make out a bill such as a man might give who had worked three days for another man at $2.25 a day.

3. Make out a note such as James Brown would give Thomas Everson in payment for 16 bbl. of flour at $5.40 a barrel.

4. As a wholesale grain dealer you sell Jan. 1 to James Smith 25 bbl. flour @ $5.75, 150 bu. wheat @ 68¢, and 240 bu. oats @ 42¢, on 3 months' credit, with 2% discount for cash. He pays one-half cash, and gives his note for the balance. Make out bill and note in proper form.

5. During the first two weeks of a year the following transactions were made by a country merchant with James Parker, a carpenter; Timothy Dexter, a farmer; and Isaac Hammond, a physician:

a. Sold Parker 8¼ lb. sugar @ 6½¢, 10 gal. kerosene oil @ 12¢, 6½ yd. of cloth @ 12¢, 6 lb. rice @ 8¢, 3¼ lb. butter @ 26¢, 3½ gal. molasses @ 35¢, 1½ lb. coffee @ 35¢. Received from him $2 in money. He has also worked for the merchant 3½ days @ $2.50 a day.

b. Sold Dexter 1 lb. tea, 65¢, 1 pr. shoes, $1.75, a bag of salt, 40¢, 4½ gal. molasses @ 35¢, 12 gal. K. oil @ 11¢, 7½ lb. cheese @ 11¢, 16 yd. sheeting @ 12¢. Received from him 6 doz. eggs @ 28¢, 8 doz. eggs @ 25¢, 6 bu. potatoes @ 58¢, 15 lb. butter @ 24¢.

c. Sold Hammond 1 bbl. flour, $5.75, 2½ lb. coffee @ 35¢, 4½ lb. butter @ 28¢, 6 qt. corn meal @ 3¢, 2½ doz. eggs @ 32¢, 4 bu. corn @ 58¢, 6 qt. cranberries @ 15¢. Received from him $5 in money, and he has made three professional calls upon a member of the merchant's family, charging $1.50 for each visit.

Open an account with each of the above parties, and make proper entries for the transactions.

Digitized by Google

SECTION VII.

MISCELLANEOUS EXERCISES.

Oral and Written.

1. What is the cost of 6 bu. of potatoes at 75¢ a bushel, and 20 qt. of oil at 12½¢ a quart?

2. What will 4250 ft. of lumber cost at $18 per M.?

3. How many dozen eggs, worth 20¢ a dozen, must be given in exchange for 8 yd. of cloth at 75¢ a yard, and 16 lb. of sugar at 5½¢ a pound?

4. How many yards in three pieces of carpet which measure 42¾ yd., 38⅝ yd., and 56⅞ yd.?

5. How long will it take 12 men to do what 8 men can do in 4½ days?

6. 9 men can do a certain piece of work in 8 days. If at the end of 3 days after they begin the work, 5 of them leave, how long will it take the remainder to finish it?

7. If the expense of burning an oil lamp is ½¢ an hour, what will be the expense of burning 6 lamps 3 hours a day during the month of April?

8. The peso of Cuba is worth $.926 of United States money. How many pesos can be bought for $1000?

9. Allowing the Mexican dollar to be worth $.669 of United States money, how much of United States money is equal to $1000 of Mexican money?

10. The mean annual rainfall during the year 1891 in Mobile was 64.1 in.; in St. Paul, 27.8 in.; in Boston, 46.4 in.; in Chicago, 32.2 in. How many cubic inches fell in each of the above cities on an area of 100 feet square? How many gallons?

11. How much butter at $⅝ a pound will pay for 16½ yd. of cloth at 62½¢ a yard?

Digitized by Google

1. If it takes each morning 5 spoonfuls of coffee for a family, and each spoonful weighs $\frac{1}{2}$ oz., how long will 3 lb. last? How much will it cost the family a year for coffee worth 35¢ a pound?

2. A farmer sold 225$\frac{1}{2}$ bu. wheat at 87$\frac{1}{2}$¢ a bushel, and took in exchange flour at $4.50 a barrel. How many barrels and pounds did he get?

3. If 750 lb. of plaster costs $8.50, what will 6$\frac{3}{4}$ T. cost?

4. A lumber merchant sold 83,500 lath at 35¢ a hundred, and 1750 ft. boards at $18.50 per M. What did he get?

5. A house valued at $7500 was insured for .75 of its value. How much was paid for insurance at 2$\frac{1}{2}$% of amount of policy?

6. A coal merchant sent to me four loads of coal weighing as follows: 2140 lb., 2380 lb., 2260 lb., 1970 lb. What must I pay for it all at $6.25 a ton?

7. What is the value of a gold chain weighing 2 oz. 8 pwt. at 90¢ a pwt.?

8. A four-ounce bottle will hold what part of a pint?

9. At 72$\frac{1}{2}$¢ an ounce, what will 6 lb. 2 oz. 12 pwt. of silver cost?

10. A grocer put 8 bbl. of flour into bags containing 60 lb. each. How many bags did he fill?

11. A man going to England exchanged 16 five-dollar gold pieces for sovereigns. How many did he get, and how many shillings over, no premium being paid in exchange?

12. A farm containing 123 A. 80 sq. rd. has 80 A. 100 sq. rd. of cleared land. How much is the woodland worth at $80 an acre?

13. A garrison of 1400 men must have how many tons of provisions to last 6 months, if each man is allowed 15 ounces a day?

14. What will it cost to fence a lot of land 8$\frac{1}{4}$ rods square at 4¢ a foot?

15. A lot of land measuring 180.42 ft. long and 68.50 ft. wide is worth how much at the rate of $500 an acre?

16. A piece of land containing $\frac{5}{8}$ of an acre measures on one side 140 ft. What is the length of the other side?

17. What is the width of the widest carpeting that will exactly fit, lengthwise or widthwise, a room 32 ft. by 24 ft.?

Digitized by Google

1. How many acres in a road $1\frac{1}{3}$ mi. long and 40 ft. wide?

2. If a man can perform a certain piece of work in $6\frac{2}{3}$ days, what part of it can he do in $4\frac{1}{4}$ days?

3. What is the cost of whitening the walls of a room $18\frac{1}{3}$ ft. by 12 ft., and 9 ft. high, at \$.025 a square yard, no allowance for openings? At 62¢ per yard, what will it cost to carpet the room, the carpet being 30 in. wide?

4. How many cords in a load of wood 8 ft. 3 in. long, 4 ft. wide, and 3 ft. 6 in. high? Cost at \$5.75 per cord?

5. How many gallons of water can a cistern contain that is 3 ft. long, 2 ft. wide, $1\frac{1}{2}$ ft. deep? If a cubic foot weighs 1000 ounces, what will be the weight of water that the cistern will hold?

6. $\frac{1}{3}$ of an ox which weighed 1305 lb. was sold to one man, $\frac{3}{4}$ of the remainder to another man. What is the value of the part unsold at $8\frac{1}{2}$¢ a pound?

7. If the average daily circulation of a newspaper is 109,680 copies, how many copies are sold in a year, and what is received for them at 2¢ a copy?

8. A circular piece of land 8 rd. in diameter contains how many square rods? How many acres?

9. If water weighs 770 times as much as air, and 1 cu. ft. of water weighs 1000 oz., how many cubic feet of air weighs a pound?

10. Bronze for making house-bells consists of four parts copper and one part tin. How much copper will be needed to make 500 bells, each weighing 10 oz.?

11. A certain kind of brass consists of two parts by weight of copper and one part of zinc. How much copper will it take to make a ton of this kind of brass?

12. How many cubic feet of earth were removed to make a well 40 ft. deep and 6 ft. in diameter?

13. How many liters of water will fill a cistern 4.40^{m} long, 3^{m} wide, and 1.60^{m} deep? How many hektoliters? How much will the cisternful of water weigh?

14. If 18 tons of coal cost \$115.20, what will $6\frac{1}{2}$ tons cost at the same price? What will 12 tons 500 lb. cost?

Digitized by Google

1. A coal dealer bought 1300 tons of coal at $5.75 per long ton, and sold it at $6.25 per short ton. Reckoning 12½¢ per long ton for freight, etc., what was the profit on the cargo?

2. I pay $450 a year for a house, and wish to sub-let it for 2 months at the same rate. What rent shall I charge?

3. A man's salary is $1500 a year, and income from other sources is $480 a year. His expenses are on an average $3.86 a day. What does he save in a year?

4. Cost of 7 lb. 4 oz. of steak at 24¢ a pound?

5. How many bushels of oats will 6 horses eat in 4 weeks, if each horse eats 12 quarts a day?

6. With oats at 60¢ a bushel, and hay at $20 a ton, how much will it cost to keep 6 horses through the winter months, if each horse eats 10 qt. of oats and 18 lb. of hay daily?

7. How far off is a thunder-cloud when there is 8 seconds' difference between the flash of lightning and the report of thunder?

8. A merchant bought 8½ quintals (cwt.) of dry fish at $6.50 a quintal, and sold it at 8½¢ a pound. What was the profit?

9. In most States a bushel of corn weighs 56 lb. and a bushel of wheat 60 lb. How many bushels of wheat will weigh as much as 148 bu. of corn?

10. Lime in slaking absorbs 2½ times its weight in water. How much will a cask of lime (240 lb.) weigh after being slaked?

11. What is a man's annual income from 8 one thousand dollar bonds of U. S. 4's? What did he pay for the bonds at 14% premium?

12. The height of a building is 64.80^{m} above the ground. How many steps will it take to reach the top, if each step is 16^{cm} high?

13. How many hektars in a field containing 28 A. 40 sq. rd.? If it is 300^{m} wide, how long is it?

14. You sell John Brown to-day 18½ yd. cloth at 16½¢ a yard, 1 pair shoes $3.50, and ¾ yd. silk at $3 a yard. Make out bill in proper form.

15. A clerk's salary of $80 a month was increased 20%. What was he paid a year after the increase?

Digitized by Google

1. How many bushels of wheat can be put into a bin 6 ft. 4 in. long, 4 ft. 2 in. wide, and 3 ft. deep?

2. How many bushels of potatoes can be put into the same bin, allowing that the heaped measure fills $\frac{1}{4}$ more space than the stricken measure?

3. How many furrows, each 18 in. wide, will be made in ploughing lengthwise a piece of land 15 rd. 8 ft. long, 8 rd. wide? How many acres in the piece?

4. A book-keeper who received \$75 a month paid for living expenses \$640 a year. After his salary increased 20%, his expenses increased 30%. After the increase, did he save more or less than before, and how much a year?

5. I pay an agent $2\frac{1}{2}\%$ for selling a piece of land for \$2460. What did I get for the land?

6. A house rents for \$450 a year, which is 15% of its cost. It cost 75% of what it was sold for. What was it sold for?

7. How many cubic inches does a pound of water occupy?

8. What is the weight of a gallon of water? of a quart? of a pint? How near is this to "a pint is a pound"?

9. A boy put \$50 into the savings-bank, and drew out the interest of 2% every 6 months for 5 years. How much did he draw out?

10. A man pays 75% of his debts, and has \$200 more to pay. How much did he owe?

11. Bought oranges at 20¢ a dozen, and sold them at a gain of 20%. For what did I sell them apiece? If I had sold them at 3¢ apiece, what should I have gained per cent?

12. A train leaves a station at 8 A.M., and goes at the rate of 20 miles an hour. When will another train, which starts at 9.45 and goes 28 miles an hour, overtake it?

13. If cloth is measured with a "yard stick" $\frac{1}{2}$ of an inch too short, what is the correct measure of a piece which appears to be 42 yd. long?

14. In 206.48 ch. how many miles?

15. A man who owned $\frac{3}{4}$ of a ship, sold $\frac{1}{3}$ of his share for \$22,000. At the same rate, what was the value of the ship?

Digitized by Google

1. A man owned at the beginning of the year $16,800 worth of real estate and $3840 worth of personal property. He sold $9200 worth and bought $6820 worth during the year. His earnings were $3450, and his expenses were $2490. What was the value of his real estate and personal property at the close of the year?

2. A man imported goods from France, invoiced at 500 francs. What was the duty in United States money at 30% *ad valorem*?

3. I bought a barrel of kerosene (42 gal.) for 9¢ per gallon. If 25% leaked out, what did it really cost me per gallon?

4. A load of hay weighed 2140 lb.; the cart weighed 430 lb. What is the hay worth at $18 a ton?

5. How many pieces of wire .005 of a yard in length can be cut from a piece of wire 150 ft. in length?

6. If pine wood is .4 as heavy as water, and a cubic foot of water weighs 62½ lb., how much will a cord of pine wood weigh?

7. If pine wood is ⅔ as heavy as oak wood, how much will a cord of oak wood weigh?

8. If a cubic foot of anthracite coal weighs 55⅓ lb., how many cubic feet weigh 1 ton? How many tons will fill a bin 9 ft. long, 4 ft. wide, and 5 ft. 3 in. high?

9. The specific gravity of ice is .92. How many tons of ice can be put into a house 20 ft. long, 12 ft. wide, and 18 ft. high?

10. How many "panes" of fence 8 ft. 6 in. long will it take to inclose a rectangular field 23 rd. 10½ ft. long and 170 ft. wide? How many posts?

11. What is the area of a circular lot of land 160 rd. in diameter? How many feet of fence will it take to inclose the lot? What will be the area of a square lot which the same fence will exactly inclose?

12. A boy bought a bicycle for $60, and after using it one year sold it at a loss of 30%. The sum that he got for the old bicycle was 66⅔% of what he paid for a new one. What was the cost of the new bicycle?

13. A grain merchant finds that the profits on corn sold during January were $180. If his profits were 20% of the cost of the corn, what was the amount of sales in corn during the month?

Digitized by Google

1. A man died insolvent with an estate valued at $15,000. If he owed $20,000, what did his estate pay on the dollar?

2. Wheat that cost 37½¢ a bushel was sold at 75¢ a bushel. What was the gain per cent?

3. A man made 20% by selling a horse for $160. What was the cost? What was the gain?

4. Find as nearly as you can by the scale the area of Colorado and of Kansas. Compare your answers with the true areas.

5. How many square feet of boards will it take to build a board-walk 58 ft. 3 in. long, 6 ft. wide, the boards to be 6 ft. long and 6 in. wide, laid crosswise, with spaces between them 1 in. wide?

6. A man bequeathed ⅔ of his estate to his wife, and the remainder to his two sons, who received $2000 each. What was the value of his estate?

7. The diameter of a wheel is 3 ft. How many revolutions will it make in a mile?

8. How many bars of iron, each weighing 38 lb. 4 oz., will it take to weigh 3 cwt. 45 lb.? to weigh 1.15 T.?

9. How many quart boxes will 3 bu. 2 pk. 6 qt. of berries fill?

10. How many rails 30 ft. long are needed to build 1200 ft. of railroad? to build 12 miles?

11. How many pills of 3 grains each can be made from ℥viij ℈ij of calomel?

12. A fruit merchant bought 67½ crates of peaches for $75, but was obliged to sell them at a loss of 10%. For what were they sold per crate?

13. What will a piece of land 200^{m} long, 150^{m} wide cost at $80 per ar?

14. What will 1684 lb. of wheat cost at $1.20 a bushel?

15. In 1880–90 the savings-banks of the United States had 4,258,623 depositors, with deposits amounting to $1,524,844,506. What was the average amount for each depositor? What per cent of the entire population (62.622,250) at that time were depositors? At 3½% a year, how much interest money was paid by the savings-banks during the year?

Digitized by Google

1. How much money in United States currency can be obtained from 16,840 Mexican silver pesos at the rate of 62¢ apiece?

2. The bushel in common use is .9692 as large as the imperial bushel of Great Britain. What would be the measure in Great Britain of 1000 bushels of wheat imported from this country?

3. A silversmith makes 6 dozen spoons of a silver dish weighing 12 lb. If silver is worth 60¢ an ounce, and the cost of making the spoons is $43.20, what is the cost of each spoon?

4. July 27, 1893, was Thursday. What day of the week was Christmas of that year? of the 4th of July, 1894?

5. 800 lb. of sugar was bought at $4.65 a hundredweight, and sold at 5¢ a pound. The freight and other expenses were $1.65. What was the gain?

6. If the gas for 6 burners 4 hours each evening during the month of May costs $2.80, what ought to be paid for the gas for 6 burners 5 hours each evening during the month of November?

7. A man let 4 houses at $18 each a month, and 3 houses at $21 each a month. How much does he get in one year for all of them?

8. A man has 2½ A. of land which he wishes to divide equally into 10 house-lots. How many square feet in each lot? If the lots are 90 ft. wide, how long are they?

9. From a pile of wood 28 ft. long, 4 ft. wide, and 4 ft. high there was sold 1½ cd. at one time, and 6 cd. ft. at another time. What is the remainder worth at $6.50 a cord?

10. How long will it take a man who earns $1.50 a day to earn $1200? How long for a man who earns $3⅓ a day?

11. Which are the cheaper, oranges at $2.50 a hundred or at 28¢ a dozen? How much cheaper would 50 doz. cost at the lower rate?

12. How many acres are covered by the great pyramid of Egypt, whose base is 764 ft. square?

13. A merchant had on hand at the beginning of the year $11,864 worth of goods and $1464 cash. His sales during the year amounted to $14,864; what he bought, $8620; expenses, $1800. On hand at close of year: goods, $12,450; cash, $1180. What was the profit or loss?

Digitized by Google

1. How many books $7\frac{1}{2}$ in. long, $5\frac{1}{2}$ in. wide, and 1 in. thick can be packed into a box 3 ft. 9 in. long, 2 ft. 9 in. wide, and 2 ft. high?

2. How many widths of carpeting 30 in. wide will be required for a room 15 ft. square? How many yards? How many widths of the same carpet will be needed for a room 16 ft. square? How many yards?

3. John was born December 30, 1879. If he is 3 yr. 8 mo. 20 da. younger than his sister, when was his sister born?

4. If the 4th of July comes on Sunday, on what day of the week will the following Christmas come?

5. What per cent of the daily sessions of your school is given to recesses? What per cent to recitation in arithmetic?

6. If in making jelly a pound of sugar is put with a pint of juice, how much sugar is required for 1 gal. $3\frac{1}{2}$ qt. of juice? How much juice could be put with 8 lb. 4 oz. of sugar?

7. If $6\frac{1}{2}$ dozen silver spoons weigh 2 lb. 6 oz., how many pounds and ounces will 8 spoons weigh? 1 dozen and 4 spoons?

8. A railroad track has a rise of 24 ft. 8 in. to the mile. How many feet rise is there in 20 miles of road? In how many miles will the rise amount to 200 ft.?

9. How many lots, each containing 70 sq. rd. 150 sq. ft., can be made from 3 A. 84 sq. rd. 111 sq. ft.?

10. How many doses, each of 6 ♏, are there in an ounce bottleful of medicine?

11. How many 4-oz. bottles can be filled from 2 gal. 3 qt. of alcohol?

12. If it takes 17 yd. of silk 27 in. wide to make a dress, how many yards will it take to make the dress if the silk is 32 in. wide?

13. If cloth that is 52 in. wide sells for $3.80 a yard, what ought to be paid for cloth of the same kind 30 in. wide?

14. How many pills of 80 mg each can be made from 16.40 g of calomel?

15. How many barrels of $31\frac{1}{2}$ gal. each will fill a cistern that is 4 ft. square and 6 ft. deep?

16. How many bushels of grain will a bin 8 ft. long, 3 ft. wide, and $4\frac{1}{2}$ ft. high hold?

Digitized by Google

1. How much will it cost to fence $2\frac{1}{2}$ miles of railroad at the rate of 42¢ a rod?

2. At 20¢ a chain, what will it cost to survey 30 miles of road?

3. How many cubic feet of stone in a cellar wall 7 ft. 6 in. high and 18 in. thick, the cellar measuring 30 ft. by 24 ft.?

4. How many yards of fencing will it take to fence a rectangular garden 240 ft. by 125 ft.?

5. What is the area in acres of a piece of land 32 chains 40 links long and 24 chains wide?

6. A rectangular field containing 6 acres is 20 rods wide. How long is it?

7. What will it cost to dig a cellar 42 ft. long, 23 ft. 6 in. wide, and 7 ft. 2 in. deep at $62\frac{1}{2}$¢ a load (cubic yard)?

8. How many cords of wood may be piled in a room 18 ft. long, 12 ft. wide, and 8 ft. 3 in. high?

9. How many bricks of the usual size in a pile which contains 1 cubic foot? Allowing $\frac{1}{3}$ of the volume for mortar, how many bricks laid in mortar will it take for a cubic foot?

10. If 2 men can do a piece of work in 6 days, how long would it take 1 man? How long 3 men?

11. If it takes 68 men 100 days to build a road, how long would it take 25 men? How many men could do it in 50 days?

12. A man has 18 bushels of potatoes. He sells $\frac{2}{3}$ of them, and the rest he divides equally among 4 families. What does each family receive?

13. A boy spent $\frac{1}{4}$ of his money, and gave away $\frac{1}{3}$ of the remainder. What part of what he had at first has he now?

14. A man owned $\frac{3}{4}$ of a ship, and sold $\frac{2}{3}$ of his share for $18,000. What is the remaining part of his share worth at the same rate? What is the entire ship worth?

15. A druggist bought 1 lb. 6 oz. 4 dr. of a certain drug at 30¢ an ounce Avoirdupois, and sold it at 50¢ an ounce Troy. What was the gain?

16. What will it cost to build a stone wall 200 ft. long, 6 ft. high, 18 in. thick, at $18 a perch? (1 perch = $24\frac{3}{4}$ cu. ft.)

Digitized by Google

1. How many bricks of the usual size will it take to build a wall 42 ft. long, 22 ft. high, 18 in. thick, no allowance being made for mortar? How many bricks laid in mortar?

2. The driving-wheels of a locomotive are 16 ft. 8 in. in circumference. How many revolutions in a mile? What is the rate of speed per hour, if the wheels revolve 3 times a second?

3. How many tiles 4 by $2\frac{1}{2}$ inches are required to make a hearth 8 ft. 3 in. long, 3 ft. 4 in. wide?

4. How many square yards of cloth will it take to cover the tops of all the desks in your school-room? How many yards 32 in. wide?

5. Which is the more, and how much: $\frac{1}{4}\%$ of 5000 or 25% of 48?

6. A boy buys apples at the rate of 2 for 3 cents, and sells them at the rate of 3 for 2 cents. What does he lose per cent?

7. If the Chicago Base Ball Club beats 18 games out of 32 games played, and the New York Club beats 16 games out of 30 games played, which club is ahead, and by what per cent?

8. A man bought a house-lot for $1250, and sold it in two years at a profit of 125%. What did he sell it for?

9. Bought a hogshead of sugar containing 9 cwt. 84 lb. for $90, and paid $5.85 for freight and carting. How much must I sell it for a pound to gain $\frac{1}{5}$ of the entire cost?

10. A piece of cloth in sponging shrank $5\frac{1}{2}\%$ of its length. How many yards will a piece contain that, before shrinking, measured $42\frac{1}{2}$ yards?

11. At $6.50 per ton, what will 4590 lb. of coal cost?

12. What is paid for insuring property valued at $4560 at the rate of 2%, the property being insured for $\frac{3}{4}$ of its value?

13. Thomas Noon can mow $\frac{7}{10}$ of a field in a day, and his son $\frac{1}{15}$ of it. How long will it take both, working together, to do it?

14. Two men have together $5340. If $\frac{2}{3}$ of D's money is equal to $\frac{5}{6}$ of E's, how much has each?

15. If you take $2\frac{3}{4}$ ft. to a step, how many steps must you take to measure half a mile?

16. What is a lot of land 8 rods wide and 120 feet long worth at 26¢ per square foot?

Digitized by Google

1. How many years, etc., from the date of the Boston Tea Party (December 16, 1773) to the present time?

2. The length of navigation of the Mississippi River by small steamboats is 2800 miles. What part of its entire length is this?

3. How high in a cart $6\frac{1}{2}$ ft. by $4\frac{1}{2}$ ft. must coal be piled to weigh a ton, if a cubic foot weighs 52 lb.? How high must coal be piled in the same cart if a cubic foot weighs 32 lb.?

4. The total increase of population in the United States from 1880 to 1890 was 12,466,467, which was 24.85% of the population in 1880. What was the population in 1880? What in 1890? The increase by immigration was 5,247,333. This is what per cent of the total increase?

5 What per cent of the entire population of the country live in the ten largest cities? What per cent live in cities having over 100,000 inhabitants?

6. The size of the planet Mercury is what part the size of the earth? How many times the size of the moon?

7. The distance from the earth to the moon is what part as great as the distance from the earth to the sun?

8. The population of Ireland in 1871 was 5,412,377; in 1881, 5,174,836; in 1891, 4,706,162. What was the per cent of decrease in each decade?

9. The population of England and Wales in 1881 was 25,974,439; in 1891, 29,001,018. What was the per cent of increase?

10. Ireland's population in 1891 was what per cent of the population of England and Wales?

11. If 88% of milk is water, how much water in 32 gal. of milk?

12. If there are 49^{Kg} of water in 70^{Kg} of potatoes, how much water in 600^{Kg} of potatoes?

13. If 9 bushels of wheat will make one barrel of flour, how many barrels of flour can be made from the wheat raised in Illinois in 1890 (18,161,000 bushels)?

14. The number of bushels of wheat raised in Illinois in 1890 was 9.6% of the number of bushels of corn raised there in the same year. How many bushels of corn were raised?

Digitized by Google

In the following problems find by all the aids you know the approximate measurements. Use also accurate measurements, so far as they can be ascertained.

1. What per cent of the land-surface of the earth is North America? Asia? Europe? Australia?

2. The size of the State in which you live is what per cent of the size of the United States? of North America?

3. The area of the United States is what per cent of the area of North America? of Europe? of Africa?

4. The area of the great central plain of North America is what per cent of the area of the entire continent?

5. What per cent of the area of the Rocky Mountain system is the area of the Allegheny Mountain system?

6. The area of the Pacific Slope of North America is what per cent of the area of the Atlantic Slope?

7. The length of the Pacific coast-line is what part of the entire coast-line of the United States?

8. How many square miles of surface to one mile of sea-coast in North America? Find the same in respect to each of the other continents.

9. The height of Mount Washington in New Hampshire is what per cent of the height of Mount St. Elias?

10. Mount St. Elias is what per cent of the height of the highest mountain in the world?

11. The elevation of the surface of Lake Ontario is what per cent of the elevation of the surface of Lake Superior?

12. What per cent of the area of Lake Superior is the area of Lake Huron? Lake Erie? Great Salt Lake?

13. What per cent of the length of the Mississippi River, from the source of the Missouri, is the length of the St. Lawrence? Rio Grande? Colorado? Connecticut?

14. What part of the area of the Atlantic Highlands is the area of the coal-fields of that region?

15. What per cent of the area of the Mississippi Valley is the area of the country where wheat grows? where sugar grows?

Digitized by Google

1. A cubic foot of water weighs 62.42 lb.; a cubic foot of gold weighs 19.36 times as much; a cubic foot of iron weighs 7.78 times as much; 19.36 is the *specific gravity* of gold; 7.78 is the S. G. of iron. Find the weight of a cubic yard of gold; of iron.

2. A cubic foot of cork weighs 14.980 lb. Find its S. G.

3. How much pressure does the bottom of a stand-pipe full of water 60 ft. high and 10 ft. in diameter sustain? Calculate for a cylindrical pipe and for a square pipe of these dimensions.

4. A column of air 1 in. square extending from the sea-level to the highest point of the atmosphere weighs 15 lb.; that is, the atmospheric pressure is 15 lb. to every square inch of surface at the sea-level. How much air does a square rod of land support?

5. At the sea-level the air not only presses down, but in all directions, with a force of 15 lb. to the square inch. There are about 2000 sq. in. on the surface of a man's body. How much pressure does his body sustain?

6. A cubic inch of air weighs about .31 grains. Find the weight of the air in a room $10' \times 20' \times 30'$.

7. The column of mercury (S. G. 13.6) in the barometer is about 30 in. high, and is supported by atmospheric pressure. If water were used instead of mercury, how long must be the tubes of the barometer?

8. The velocity of sound is how many meters per second?

9. Five seconds elapse between the flash and the report of a thunderbolt. How far away did it strike?

10. Eight and a quarter seconds elapse between the flash and the report of a gun. How far away is the gun from the listener?

11. If a speaking-tube should connect two cities 8 miles apart, how long would it take to get an answer to a question spoken through the tube, reckoning from the last word of the question?

12. An echo is produced by the sound-waves striking some object, which reflects them as a ball is reflected from a building when thrown against it. A man shouting to his cattle hears his own words repeated in 6 seconds after he has uttered them. How far away was the cliff which produced the echo?

Digitized by Google

Measures of Length.

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
5½ yards = 1 rod (rd.)
320 rods = 1 mile (mi.)

7.92 inches = 1 link (li.)
100 links = 1 chain (ch.)
80 chains = 1 mile.

---

6 feet = 1 fathom.
120 fathoms = 1 cable length.
6086 feet = 1 knot.
3 knots = 1 league.

---

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
360 degrees = 1 circle.
69⅛ miles = 1° of longitude on equator or of latitude on a meridian.

Measures of Surface.

144 square inches = 1 square foot.
9 square feet = 1 square yard.
30¼ square yards = 1 square rod.
160 square rods = 1 acre (A.)
10 square chains = 1 acre.
640 acres = 1 square mile.
1 mile square = 1 section of land.
36 square miles = 1 township.
100 square feet = 1 square of flooring or roofing.

Measures of Volume.

1728 cubic inches = 1 cubic foot.
27 cubic feet = 1 cubic yard.
24¾ cubic feet = 1 perch.
16 cubic feet = 1 cord foot (cd. ft.)
8 cord feet = 1 cord (cd.)

Measures of Weight.

Avoirdupois Weight.

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (cwt.)
20 hundredweight = 1 ton (T.)
2240 pounds = 1 long ton.
196 pounds = 1 barrel of flour.
200 pounds = 1 barrel of beef or pork.

Apothecaries' Weight.

20 grains (gr.) = 1 scruple (sc. *or* ℈)
3 scruples = 1 dram (dr. *or* ʒ)
8 drams = 1 ounce (oz. *or* ℥)
12 ounces = 1 pound (lb. *or* ℔)

Troy Weight.

24 grains (gr.) = 1 pennyweight (pwt.)
20 pennyweights = 1 ounce.
12 ounces = 1 pound.

Measures of Capacity.

Liquid Measure.

4 gills (gi.) = 1 pint (pt.)
2 pints (pt.) = 1 quart (qt.)
4 quarts = 1 gallon (gal.)
1 gallon contains 231 cubic inches.

Apothecaries' Measure.

60 drops (gtt.) *or* minims (♏) = 1 fluid dram (*f*ʒ)
8 fluid drams = 1 fluid ounce (*f*℥)
16 fluid ounces = 1 pint (O)
8 pints = 1 gallon (Cong.)

Dry Measure.

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)
1 bushel contains 2150.42 cubic inches.

Digitized by Google

Measures of Value.

10 mills (m.) = 1 cent (¢ or ct.)
10 cents = 1 dime (d.)
10 dimes = 1 dollar ($)

---

4 farthings = 1 penny (*d.*)
12 pence = 1 shilling (*s.*)
20 shillings = 1 pound (£) = $4.866.

---

100 centimes (ct.) = 1 franc (fr.) = $.193

---

100 pfennigs (pf.) = 1 Mark (M.) = $.238

---

100 kreutzers (kr.) = 1 florin (fl.) = $.453

---

100 kopecks (ko.) = 1 rouble (rb.) = $.734

Measures of Time.

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (h.)
24 hours = 1 days (da.)
7 days = 1 week (wk.)
365 days *or* 366 days } = 1 year (yr.)
12 months (mo.) = 1 year.

Miscellaneous Table.

12 things = 1 dozen.
12 dozen = 1 gross (gr.)
12 gross = 1 great gross (G. gr.)
24 sheets = 1 quire (qr.)
20 quires = 1 ream (rm.)
10 reams = 1 bundle.

Metric System of Weights and Measures.

Prefix.	Abbreviation.	Ratio.
Milli-	(m)	= .001
Centi-	(c)	= .01
Deci-	(d)	= .1
——		= 1
Deka-	(D)	= 10
Hekto-	(H)	= 100
Kilo-	(K)	= 1000
Myria-	(M)	= 10000

Standard Units.

Meter (m)
Square meter ($^{q\,m}$)
Cubic meter ($^{cu\,m}$)
Liter (l)
Gram (g)

Volume.

$1000^{cu\,mm} = 1^{cu\,cm}$
$1000^{cu\,cm} = 1^{cu\,dm}$
$1000^{cu\,dm} = 1^{cu\,m}$

$1^{cu\,m}$ = 1 ster (st) of wood

Length.

$10^{mm} = 1^{cm}$
$10^{cm} = 1^{dm}$
$10^{dm} = 1^{m}$
$10^{m} = 1^{Dm}$
$10^{Dm} = 1^{Hm}$
$10^{Hm} = 1^{Km}$

Surface.

$100^{q\,mm} = 1^{q\,cm}$
$100^{q\,cm} = 1^{q\,dm}$
$100^{q\,dm} = 1^{q\,m}$
$100^{q\,m} = 1^{q\,Dm}$
$100^{q\,Dm} = 1^{q\,Hm}$
$100^{q\,Hm} = 1^{q\,Km}$

---

100 centars (ca) = 1 ar (a)
100 ars = 1 hektar (Ha)

Capacity.

$10^{ml} = 1^{cl}$
$10^{cl} = 1^{dl}$
$10^{dl} = 1^{l}$
$10^{l} = 1^{Dl}$
$10^{Dl} = 1^{Hl}$
$10^{Hl} = 1^{Kl}$

Weight.

$100^{mg} = 10^{cg}$
$10^{cg} = 1^{dg}$
$10^{dg} = 1^{g}$
$10^{g} = 1^{Dg}$
$10^{Dg} = 1^{Hg}$
$10^{Hg} = 1^{Kg}$
$1000^{Kg} = 1$ ton (T)

For equivalents in United States measures, see page 44.

Digitized by Google

ADVERTISEMENTS

Digitized by Google

Digitized by Google

The Jane Andrews Books.

By JANE ANDREWS.

A remarkable series of attractive and interesting books for young people, — written in a clear, easy, and picturesque style. This is the famous Jane Andrews series which has been for many years an old-time favorite with young folks.

These new editions will doubtless increase the irresistible charm that the books always have maintained for their youthful admirers.

THE SEVEN LITTLE SISTERS WHO LIVE ON THE ROUND BALL THAT FLOATS IN THE AIR. 12mo. Cloth. 143 pages. For introduction, 50 cents.

The seven sisters represent the seven races, and the book shows how people live in the various parts of the world, what their manners and customs are, what the products of each section are and how they are interchanged.

EACH AND ALL; THE SEVEN LITTLE SISTERS PROVE THEIR SISTERHOOD. 12mo. Cloth. Illustrated. 162 pages. For introduction, 50 cents.

This continues the story of Seven Little Sisters, and tells more of the peculiarities of the various races, especially in relation to childhood.

THE STORIES MOTHER NATURE TOLD HER CHILDREN. 12mo. Cloth. 161 pages. For introduction, 50 cents.

Dame Nature here unfolds some of her most precious secrets. She tells about the amber, about the dragon-fly and its wonderful history, about water-lilies, how the Indian corn grows, what queer pranks the Frost Giants indulge in, about coral, and starfish, and coal mines, and many other things that children delight to hear of.

JAMES PARTON, the Historian, called the author of these books "the best teacher in the world."

Nothing equal to this remarkable book.

JOHN G. WHITTIER once wrote a charming letter to Miss Andrews about her "Ten Boys." Let us note what he says: "I . . . cannot forbear saying that in all my acquaintance with juvenile literature I know of nothing in many respects equal to this remarkable book, which contains in its small compass the concentrated knowledge of vast libraries. It is the admirably told story of past centuries of the world's progress, and the amount of study and labor required in its preparation seems almost appalling to contemplate. One is struck with the peculiar excellence of its style, — clear, easy, graceful, and picturesque, — which a child cannot fail to comprehend, and in which 'children of a larger growth' will find an irresistible charm."

Digitized by Google

Books of genius are rare, and rarest of all among books for schools. The **Jane Andrews Books** appear to be of this remarkable sort. They are not to be classed with the good but commonplace things that any of us might write on the same subject. There is found about them the certain indefinable *something* which, as the ancients said of the walk of their divinities, reveals more than ordinary mortal. As a consequence they possess a peculiar quality of life and interest and inspiration. They not only instruct, but quicken. They have power to change a brain into a mind.

TEN BOYS WHO LIVED ON THE ROAD FROM LONG AGO TO NOW. 12mo. Cloth. 243 pages. For introduction, 50 cents.

The History of the World, summarized in the stories of Kabla the Aryan boy, Darius the Persian boy, Cleon the Greek boy, Horatius the Roman boy, Wulf the Saxon boy, Gilbert the Knight's page, Roger the English boy, Fuller the Puritan boy, Dawson the Yankee boy, and Frank Wilson the boy of 1885.

GEOGRAPHICAL PLAYS. 12mo. Cloth. 140 pages. For introduction, $1.00.

These able, suggestive, and interesting plays are designed as a sort of review of each country or topic, and they present a comprehensive view of the subject as a unit. They are used after a country has been faithfully studied from the geography, and when the pupil has become familiar with all names given in the play. It need scarcely be said that the plays are well written, and are calculated to produce an animating effect *upon a school.* They are used in Boston Primary Schools for Supplementary Reading.

DO you wish to give the boys and girls of your town four of the most delightful books ever written? Add the Jane Andrews books to your school library.

Renewed interest at each reading.

I have seen a six-year-old girl read Jane Andrews' Seven Little Sisters, and Each and All, repeatedly, with renewed interest at each reading.—MARY E. BURT, *in "Literary Landmarks."*

Incomparable in their way.

They are incomparable in their way as an introduction to school work in Geography. They are sure to hold a permanent place in the common school.—LOUISA P. HOPKINS, *Supervisor of Schools, Boston, Mass.*

Remember that the Jane Andrews books are published by Ginn & Company.

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

BOOKS FULL OF LIFE AND THOUGHT

WENTWORTH'S ARITHMETICS

Their motto is mastery, their method is learn to do by doing

MONTGOMERY'S AMERICAN HISTORY

A panorama of the leading facts their causes and their results

STICKNEY'S READERS

Best in idea and play, best in matter and make best in interest and results

CLASSICS FOR CHILDREN

Choice literature, judicious notes, large type, firm binding, low prices

STICKNEY'S WORD BY WORD

An improved spelling course in two numbers, conservative and original

BLAISDELL'S PHYSIOLOGIES

Endorsed by the physicians, the scientific men, the moralists, the teachers and the W.C.T.U.

TARBELL'S LESSONS IN LANGUAGE

Expression through written forms made as natural as thought and speech

THE NEW NATIONAL MUSIC COURSE

Studied by more pupils than all other regular courses together

GINN & COMPANY PUBLISHERS

Digitized by Google